

ADVISORY

We are pleased to provide a Powerpoint presentation that we hope will be useful to those who work, or plan to work, on spawning aggregations, do not have ready access to photographic material, or simply wish to learn more about aggregations. Please adjust format as you require.

PLEASE NOTE, however, that the photos provided must always include the embedded credit and cannot be used for commercial purposes, or for uses other than Powerpoint presentations.

The information provided and displayed in graphs is based on the database at www.SCRFA.org and on SCRFA's work. For more information on the data, for references, or for general information on spawning aggregations please refer to the website. Additional information may be obtained by contacting: SCRFA@hkucc.hku.hk. Full citations are available on the website



SCRFA 2005

Funded by the David and Lucile Packard Foundation

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What is a spawning aggregation?

A group of fish that forms for the purpose of spawning (i.e. reproduction)

The photo shows a group of snapper that has formed for the purpose of spawning

The mixture of sperm and eggs is visible as a large white cloud in the photograph



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Two general types of spawning aggregation are recognized

☛ **Resident** aggregations form frequently, sometimes daily, close to home reefs and in many different locations (*examples are found in surgeonfishes and some wrasses and parrotfishes*)

☛ **Transient** aggregations form tens or hundreds of kilometers away from home reefs, for short periods each year and in relatively few places (*examples are found in groupers, snappers, rabbitfishes, etc.*)

Domelier and Colin, 1997

How are spawning aggregations identified?

Spawning: determined from 'direct' or 'indirect' signs

Direct: spawning observations and gravid (full of eggs) females

Indirect: body colors and behavior known only to be associated with spawning; seasonally high landings of ripe fish

Aggregation: determined from significant density increases, compared to the non-reproductive season



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DIRECT indications of spawning include observation of spawning (top centre) or hydrated eggs (see bucket).

In histological sections 'S5' stage eggs are hydrated and ready for release (lower right), while POFs (post-ovulatory follicles-upper right) remain after spawning for a short time and signal very recent spawning

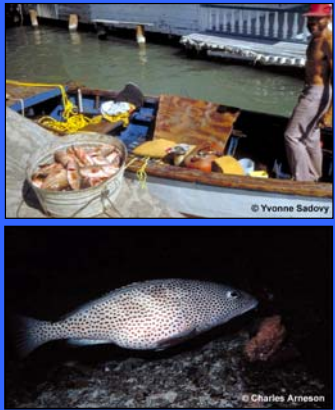


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Ripe female grouper (red hind, *Epinephelus guttatus*), full of eggs. Large numbers of red hind are caught before they have a chance to spawn



© Yvonne Sadovy
© Charles Arneson

BUT be careful, fat fish are not always full of eggs!


Fat bodies and large food items can also swell the abdomen and be misleading

As one example, the photo on the right shows juvenile snapper with large abdominal fat bodies (arrow)



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INDIRECT indications of imminent spawning in males can include specific behaviours or colors known only be associated with spawning



For example, the tiger grouper, *Mycteroperca tigris*, shows characteristic male-male display (above) or male coloration (lower right; yellow head and white ventral area) associated with spawning. Non-spawning coloration is above left

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In 1996 the Nassau grouper was listed as 'Endangered' on the IUCN Red List of Threatened Species and is a candidate for the U. S. Endangered Species List; largely because of aggregation-fishing

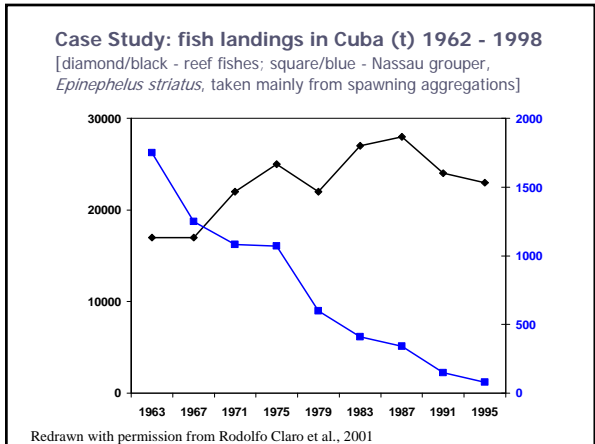


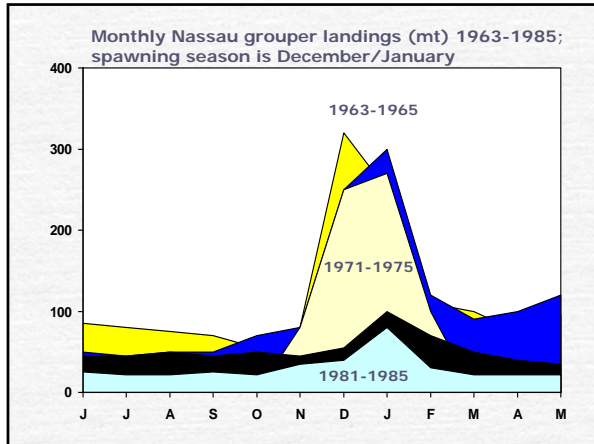
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Spawning aggregation of Nassau grouper, *Epinephelus striatus*, showing fish assembling on substrate and then rising up into the water column to spawn, as dusk approaches



© Seapics
© Seapics





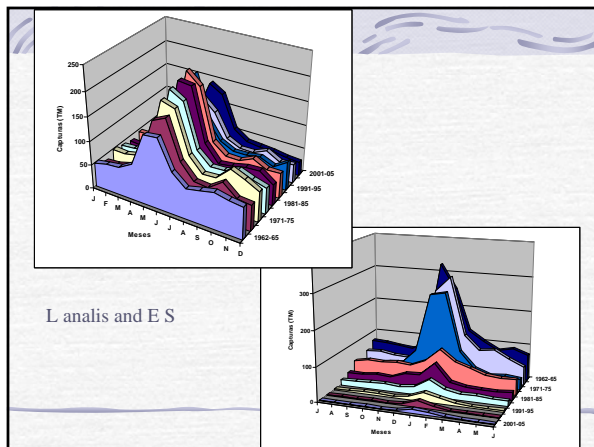
Snappers and groupers, including several aggregating species, in the live reef fish food trade, shown in a retail market in Hong Kong.

Indo-Pacific spawning aggregations are being fished for this large international market which expanded enormously between the 1960s and the 1990s



Species	Increasing	Stable	Decreasing	Collapsing
Camouflage	2	5	15	10
Brown-marbled	2	5	15	10
Squaretail coral	2	5	15	10

Three grouper species that sometimes spawn in the same location are the camouflage, the brown-marbled and the squaretail coral grouper: they are often fished in their aggregations for both live and chilled fish markets and many aggregations show declines



Not just groupers and snappers, but a wide range of commercially important reef fishes spawn in aggregations, including some rabbitfishes (Siganidae), mullets (Mugilidae), emperors (Lethrinidae) and jacks (Carangidae), among others.....



Healthy aggregations maintain fisheries. Aggregation-fishing at low and subsistence- only levels may be sustainable. However, commercial level aggregation-fishing is typically not sustainable without management

High seasonal landings may be an indication of a spawning aggregation. However, this should be validated by further work since changes in the fishery, unrelated to aggregating fishes, could also produce such patterns: examining the gonads would be a useful addition

Conservation and Management of Reef Fish Spawning Aggregations



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LEARNING ABOUT SPAWNING AGGREGATIONS

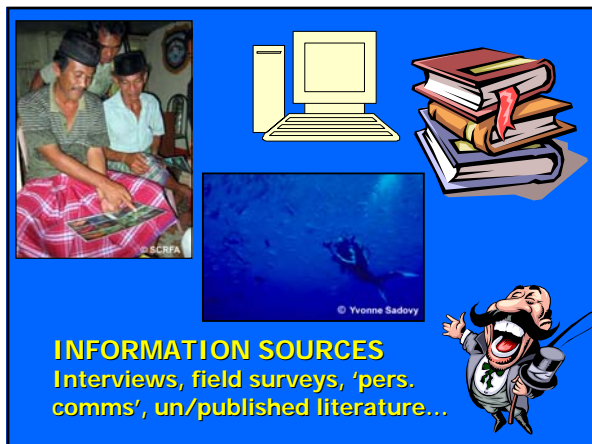
To effectively understand, conserve and manage reef fish spawning aggregations and aggregating species, good scientific protocols must be developed for research and monitoring.

Failure to adopt good science to validate reported aggregations or to collect the necessary information for management could lead to waste of time and money, or yield outcomes that are ineffective, or detrimental

SCRFA Mission Statement

To promote and facilitate the conservation and management of reef fish spawning aggregations....

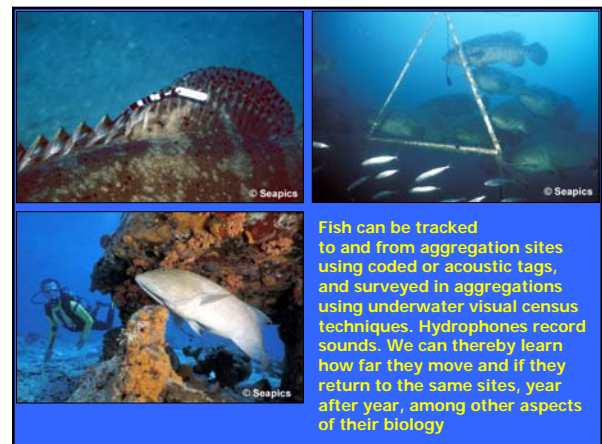
...by building a strong case for their protection and management



INFORMATION SOURCES

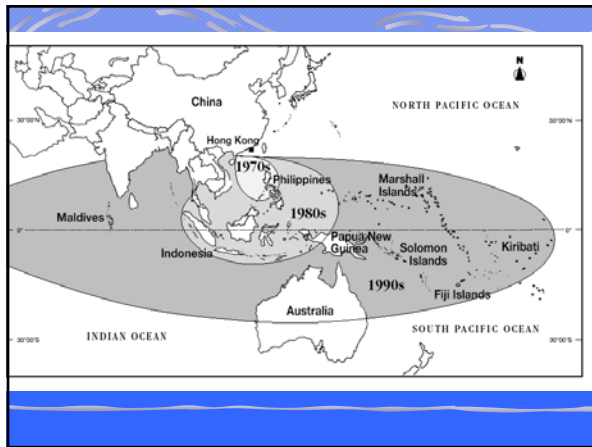
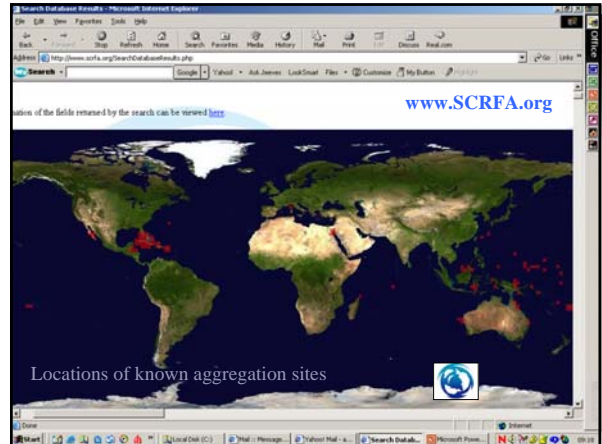
Interviews, field surveys, 'pers. comms', un/published literature....

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Fish can be tracked to and from aggregation sites using coded or acoustic tags, and surveyed in aggregations using underwater visual census techniques. Hydrophones record sounds. We can thereby learn how far they move and if they return to the same sites, year after year, among other aspects of their biology

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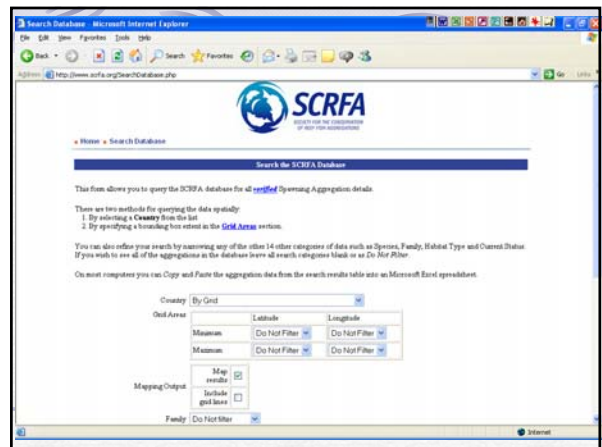
Example of information available on SCRFA database

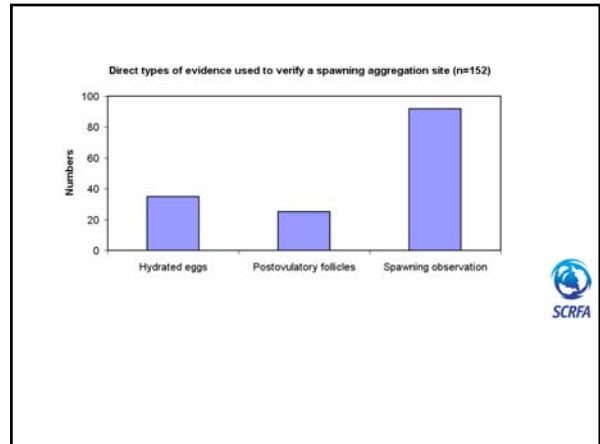
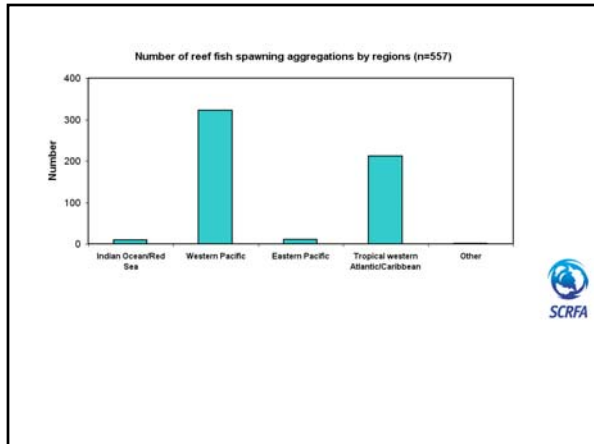
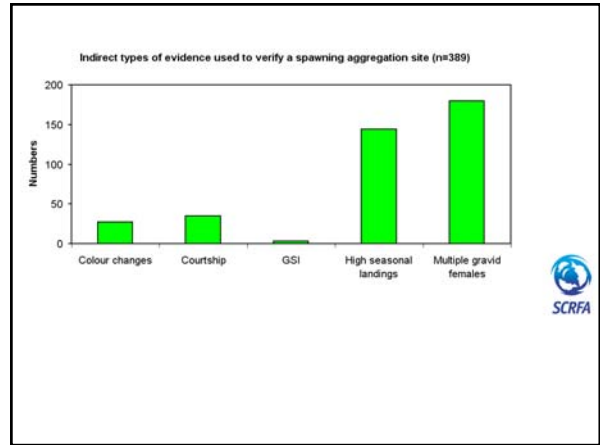
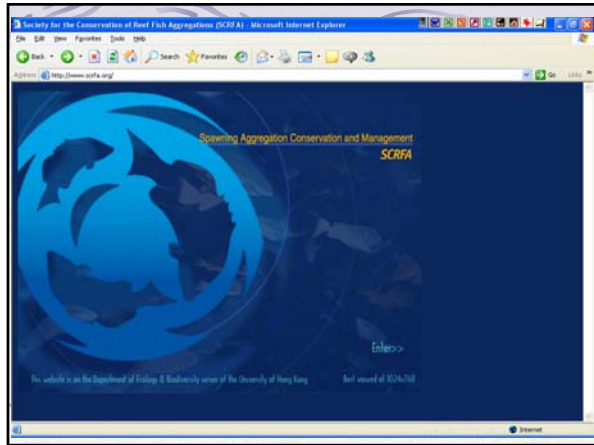
Habitat	Agg. type	Direct Evidence	Indirect Evidence	Current Status	Current Status Notes
Shoal channels	Dispersed	Spawning observation	Dispersed	Unknown	None
Open and grass	Dispersed	Spawning observation	Dispersed	Unknown	None
Dispersed	Dispersed	Spawning observation	Dispersed	Unknown	None
Dispersed	Dispersed	Spawning observation	Dispersed	Unknown	None
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Dispersed	Dispersed	Spawning observation	Dispersed	Unknown	None
Open and grass	Dispersed	Spawning observation	Dispersed	Unknown	None
Dispersed	Transient	Hybridized eggs, Postembryonic failure	Dispersed	Increasing	Hybridized with only 100% of 13 seasons, 1993-2002
Dispersed	Dispersed	Hybridized eggs, Postembryonic failure	Dispersed	Unknown	None
Dispersed	Transient	Hybridized eggs, Postembryonic failure	Dispersed	Increasing	Spawning biomass has recovered steadily since the last season (October 8, September 2002)
Shoal, Mud	Resident	Hybridized eggs, Postembryonic failure	Dispersed	Increasing	Spawning biomass has recovered steadily since the last
Dispersed	Transient	Hybridized eggs, Postembryonic failure	Dispersed	Unknown	None

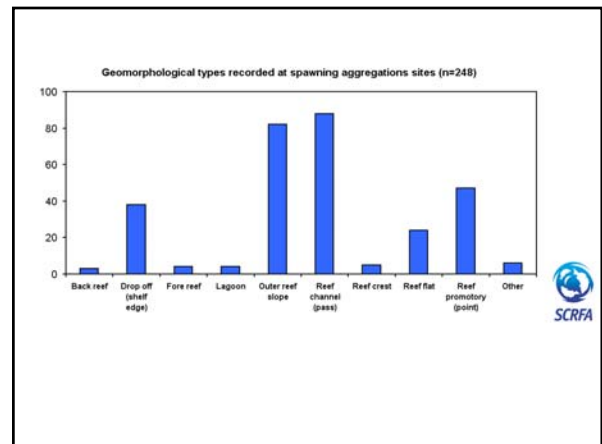
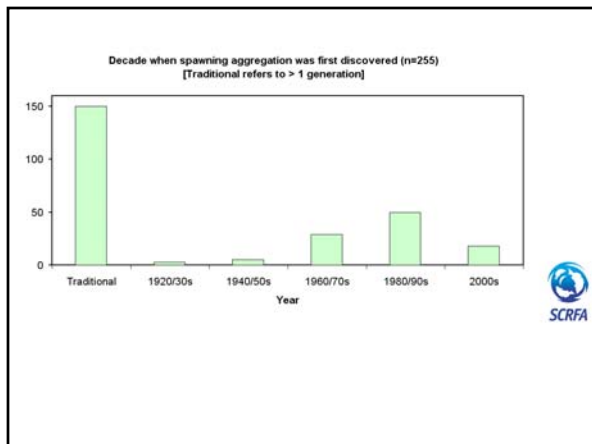
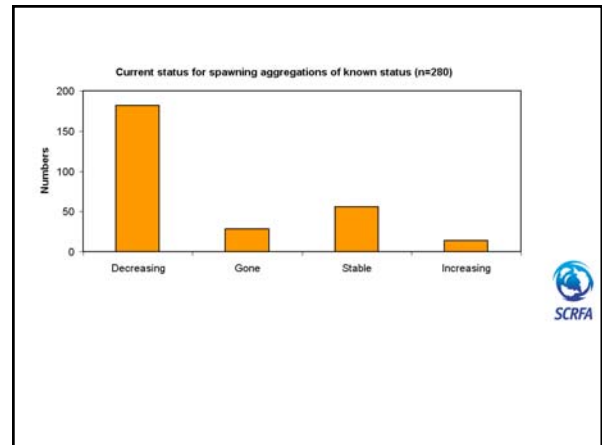
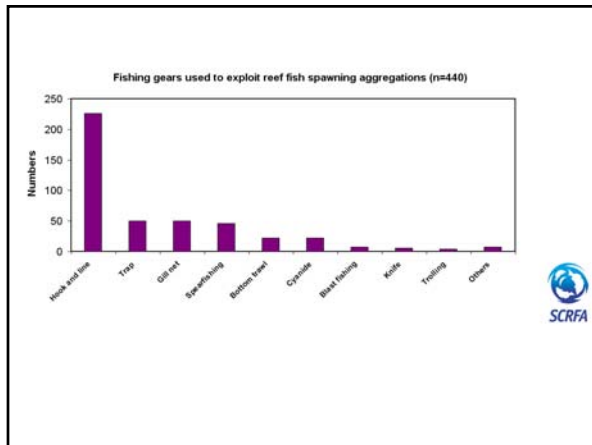
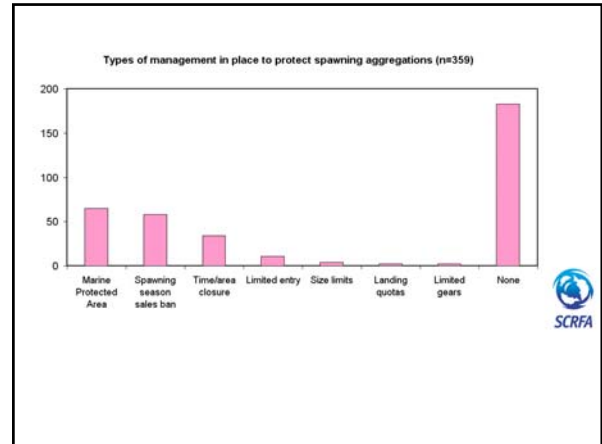
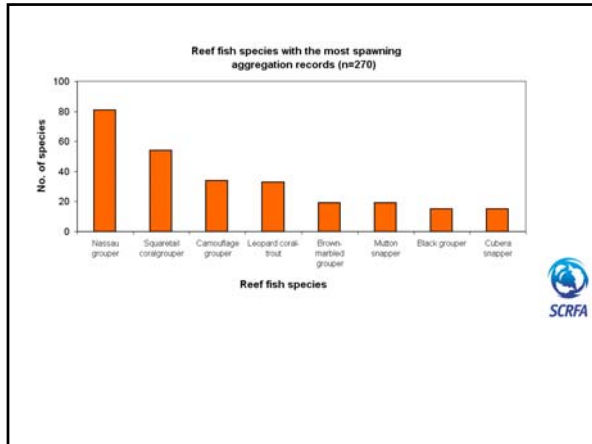
Example of information available on SCRFA database

590 records found

Row	Country	Family	Genus	Species	Common Name(s)	Local Name	Months of spawning	Agg. Type
1	American Samoa	Acanthaceae	Acanthaceae	guttata	White-spotted surgeonfish	Dispersed	July	Other
2	American Samoa	Acanthaceae	Acanthaceae	guttata	White-spotted surgeonfish	Dispersed	January, February, March, April, May, June, July, August, September, October, November, December	Reef/Chaos (open)
3	American Samoa	Acanthaceae	Acanthaceae	guttata	White-spotted surgeonfish	Dispersed	June	Reef/Chaos (open)
4	American Samoa	Labiidae	Thalassoma	herdmani	Silky wrasse	Dispersed	January, March, May, July, August, September, October	Reef/Chaos (open)
5	American Samoa	Acanthaceae	Acanthaceae	lineata	Lead surgeonfish	Dispersed	January, February, March, April, May, June, July, August, September, October, November, December	Reef/Chaos (open)
6	American Samoa	Labiidae	Thalassoma	opacirostratum	Frontalis wrasse	Dispersed	January, February, March, April, May, June, July, August, September, October, November, December	Reef/Chaos (open)
7	American Samoa	Acanthaceae	Acanthaceae	lineata	Crown surgeonfish	Dispersed	January, February, March, April, May, June, July, August, September, October, November, December	Reef/Chaos (open)
8	Australia	Sparidae	Pagrus	caeruleus	Spinefish, Pink snapper	Open, Pull	April, May, June, July, August, September, October	Other
9	Australia	Sparidae	Pagrus	caeruleus	Spinefish, Pink snapper	Open, Pull	April, May, June, July, August, September, October	Other
10	Australia	Sparidae	Pagrus	caeruleus	Spinefish, Pink snapper	Open, Pull	April, May, June, July, August, September, October	Other







Statement of Concern adopted by the second Inter-Tropical Marine Ecosystem Management Symposium in March 2003

Spawning aggregations should be conserved, through judicious management or complete protection, to ensure persistence of the fish populations and species that form them, the integrity of reef ecosystems and the livelihoods and food supply of communities that depend on aggregating species

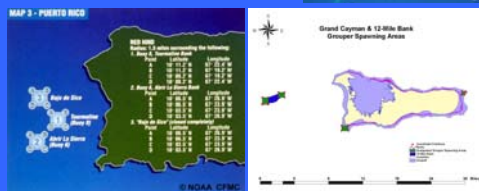
IUCN Recommendation

In November, 2004, a Recommendation to better protect and manage reef fish spawning aggregations was adopted by the 4th IUCN World Fisheries Congress. See Recommendation 3.100, on p. 127 of the Resolutions and Recommendations on Reef-Fish Spawning Aggregations

Management options for aggregating species

1. Inclusion of spawning site in a marine protected area
2. Temporary closure of spawning site
3. Seasonal ban on fishing during spawning season
4. Sales ban during spawning season
5. Conventional management (quota, size limits, etc.) throughout the year

Aggregations are often predictable in space: depending on the species and region, they regularly occur (clockwise) in reef channels, at promontories, or at specific outer reef areas close to deeper water.

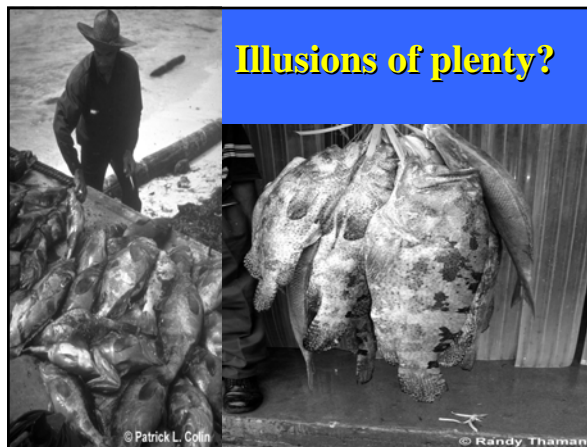


Such areas can be protected

When it may be best to protect aggregating species during the spawning season (rather than outside of the season)

1. When the price per fish is too cheap
2. When enforcement is easier
3. If the species changes sex; aggregations may be important for communicating information on sex ratios and sex change
4. If there is high wastage due to predation when hooked, or to mortalities in egg-bound fish when needed for the live fish trade
5. If fishing severely disrupts spawning activity
6. If most annual catch is during the spawning season and the species is over-fished

Illusions of plenty?



© Patrick L. Colin

© Randy Thaman

Illusions of plenty?

The large numbers of fish taken at some spawning aggregations give the impression that the species is abundant. This can hide the less obvious possibility that, for some species, one or a few large aggregations may represent all the adults in a population. If those aggregations are lost, the population may not persist.