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2005/024

Fine Scale management

Prepared by Rob Day



Photo: Rob Day



Photo: Harry Gorfine

Training syllabus Module 3
for the Abalone Fishing Industry
delivered as part of FRDC project 2005/024



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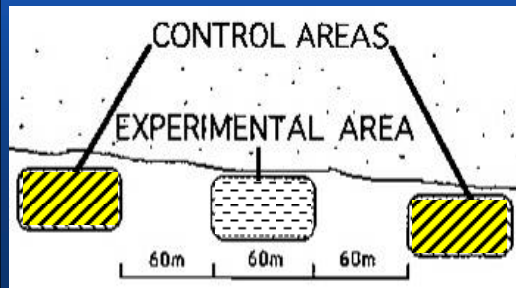
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Why Fine Scale Management?

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1a. We know local parents are needed

- When Jeremy Prince removed mature fish from 60m areas in Tasmania (Experimental area), there were reduced spat found compared to control areas (yellow)
- Thus local parents produce most of the next generation.



Source: J. Prince

AVERAGE RESULT OF 4 EXPERIMENTS



Why Fine Scale Management?

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1b. We know abalone larvae don't go far

- The larvae swim near the bottom & settle in a few days
- Paul McShane showed that under kelp weed they would not be carried far.
- So again, stocks depend on local parents

Larvae cannot swim
against currents



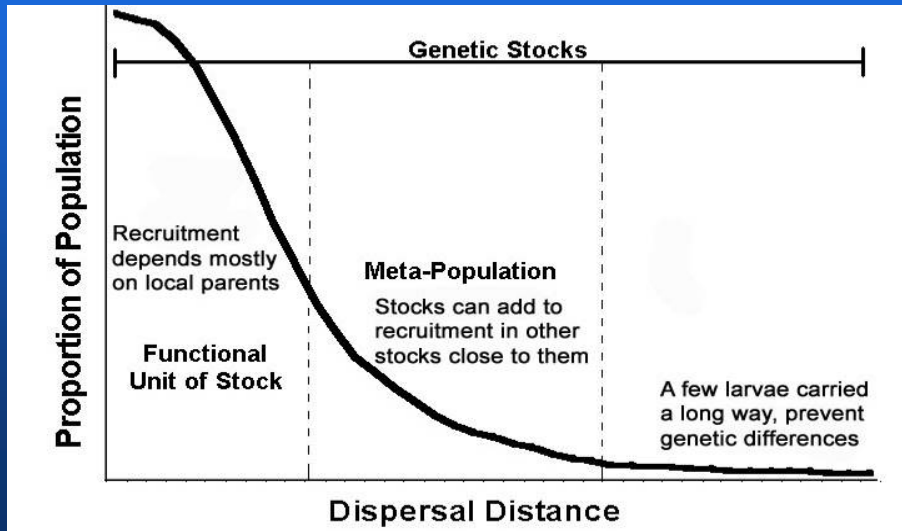
Photo: Anton Krsinich



Local stocks depend on local parents

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Genetic differences begin at much greater distances



Why Fine Scale Management?

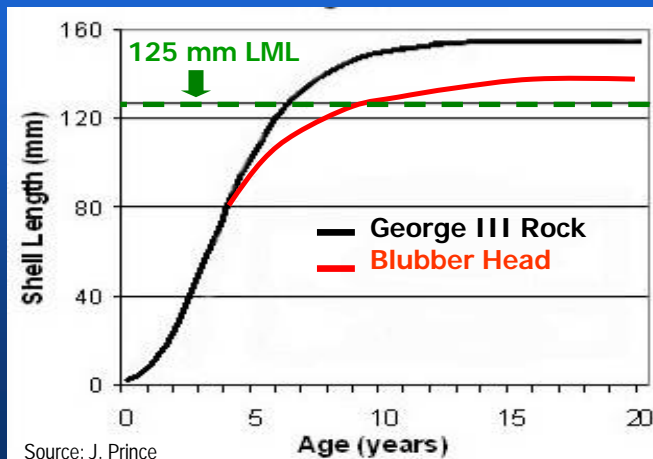
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- 2a. In each area they grow to different sizes
- So they cross size limits at different ages

Growth at 2 sites from Prince's work in Tasmania.

Gonads develop as growth slows.

So George III fish reach the size younger and with little gonad.



Why Fine Scale Management?

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2b. Maturity relates to age

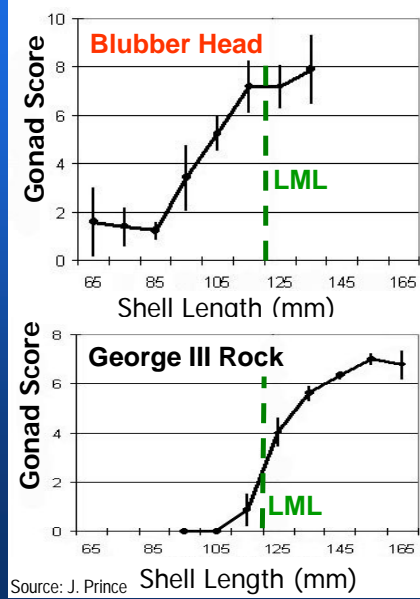
- So slow growth fish mature much smaller.
- They develop much larger gonads for their size.



Blubber Head abalone (top) have big gonads at the LML (Green line).

But gonads have just begun to develop at Georges.

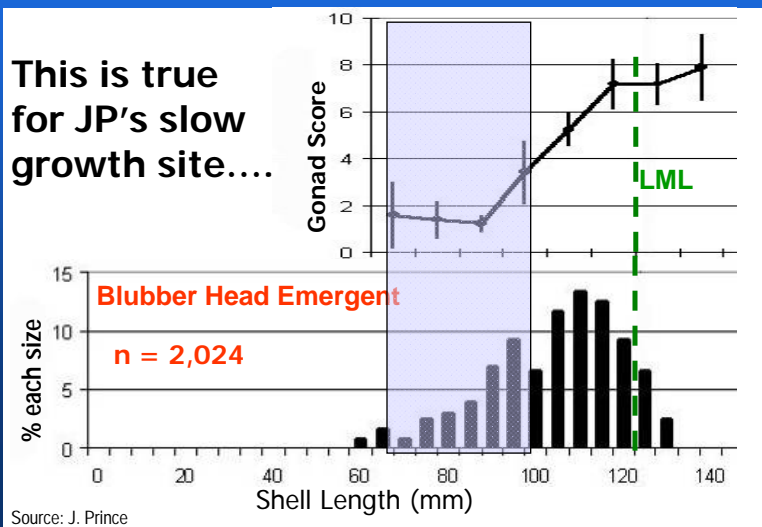
Photos: Harry Gorfine



They emerge as the gonad grows

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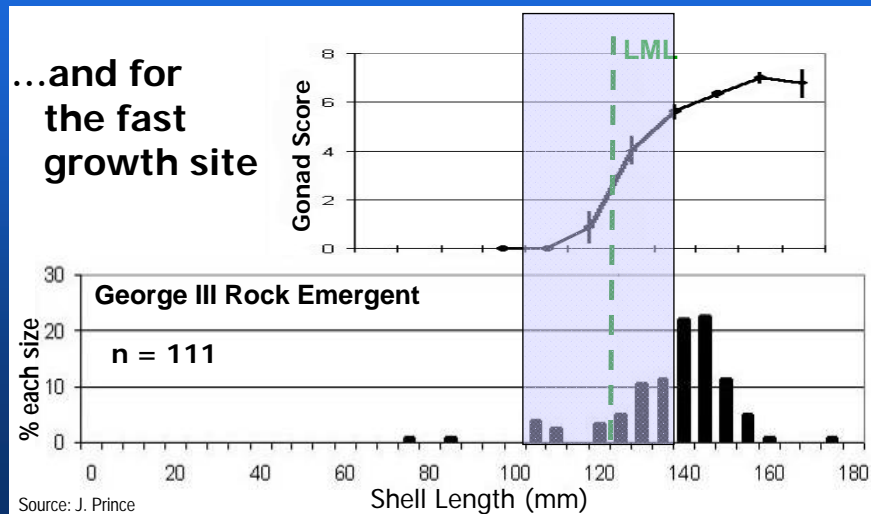
- When divers first see them, the gonad is small (blue shaded area)



They emerge as the gonad grows

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- When divers first see them, the gonad is small (blue shaded area)



The need for Fine Scale Management

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- Local stocks depend on local parents
- Local areas need different LMLs
 - Growth rate, Size of gonad development, Max size differ
- Some reef-code stocks will stay small
 - Here low LMLs are needed to access stocks
- Some reef-code stocks will have mixed sizes
 - e.g. inshore stunted, offshore larger
 - Here, stunted fish may sustain overall egg production
- Other reef-codes may require high LMLs
 - Because large gonads only develop in large fish
 - These are the high growth, productive reefs
- One overall LML will deplete the productive stocks
 - Then pressure will turn to the next best, etc.

The Serial Depletion Problem

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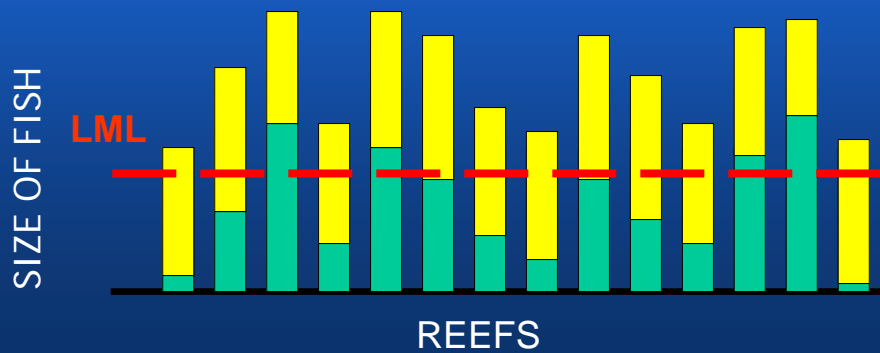
➤ Fast growers mature larger



MATURE



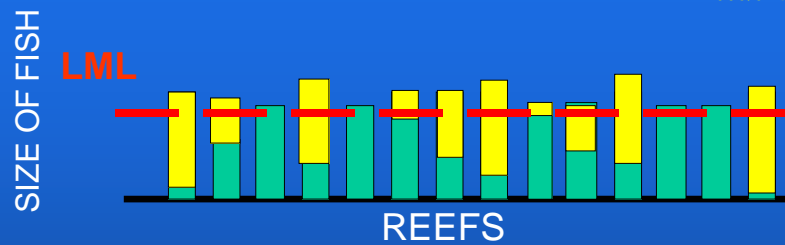
➤ Which reefs would you drop on?



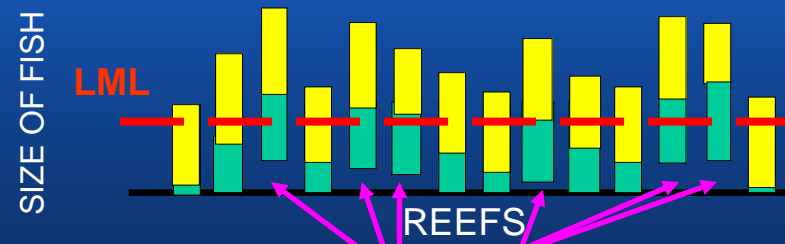
Photos: Rob Day, Harry Gorfine

After fishing

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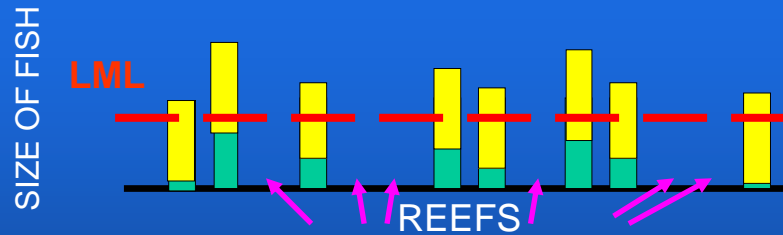
Next year



None mature after fishing leads to gaps in new juveniles

5-8 yrs time

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- Divers use fewer reefs,
+ more scratching for sized abs
- But surveys of selected reefs still show numbers OK
– So zonal model shows 'no problem'

We think growth increases if fishing is severe
(density dependent growth – see Module 4).
This would make the problem worse !

No state management at fine scales

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- Every reef requires different management
- Government cannot enforce local rules
– And cannot survey all reefs each yr
– But catch is reported at the local scale
- A lack of data to model reef-codes
– Few reefs have time series of monitoring
– Need also growth rates, SOMs, etc for the reef
– So fitting risk-based assessment models not possible
– Except for reefs surveyed by Gorfine's teams

Industry Fine Scale Management

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- Divers can apply local size limits and voluntary catch caps
 - **IF** everyone follows group decisions, then ALL can benefit
 - Experience shows temptation must be low!
 - ALL stakeholders must be able to participate openly
- Need a method to assess LML needed, and state of stocks
 - Prince's method: shell doming to indicate egg production and Increasing / declining catches indicate stock status



Photos: R Day, J Prince

Emergence and doming

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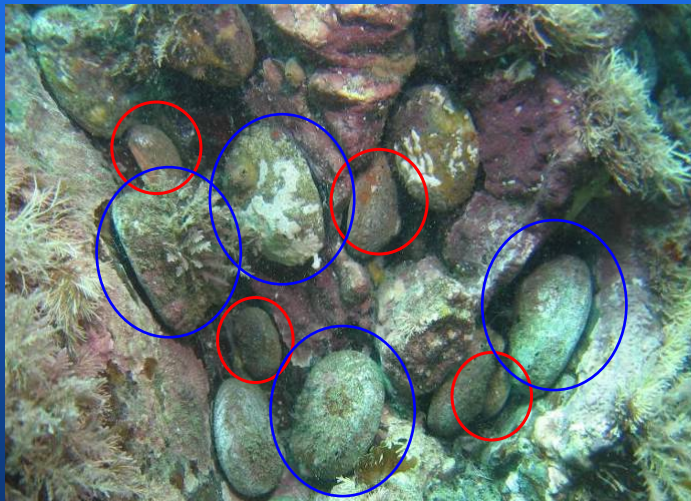


Photo: J Rudge

Blue shows large domed, fouled fish in the open
Red shows small flat abalone back in crevices

Reading Abalone Shells

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- Juveniles hide in cracks in the reef.
 - They grow long thin and flat.
 - As they live in the dark, the shells are free of fouling weed etc.
- As they mature, abs move out of cracks and thicken the shell
 - They slowly get higher and rounder (extra volume for gonads).
 - They become fouled by algae.
- It takes several years to develop full egg production.
 - Abs should breed with large gonads for 2-3 yr before being harvested.
 - Harvested abs should be high, rounded and well fouled.
- If the catch is mostly clean flat shells, the reef is over-fished
 - because abalone are not being left to attain full adult fecundity.



3 Crags abalone
with increasing
gonad sizes

Photos: Rob Day

Size does not indicate gonad

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- Abalone above the tape are domed, below not.



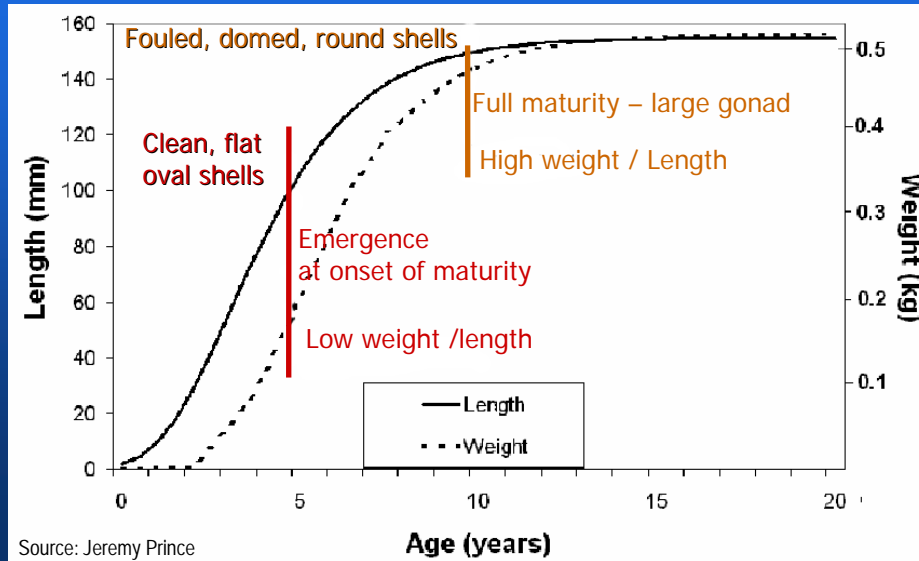
All fish sized,
from Vic. WZ

Photo: Jeremy Prince

Changes in Size, Doming & Gonad

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➤ Higher LMLs mean much heavier fish

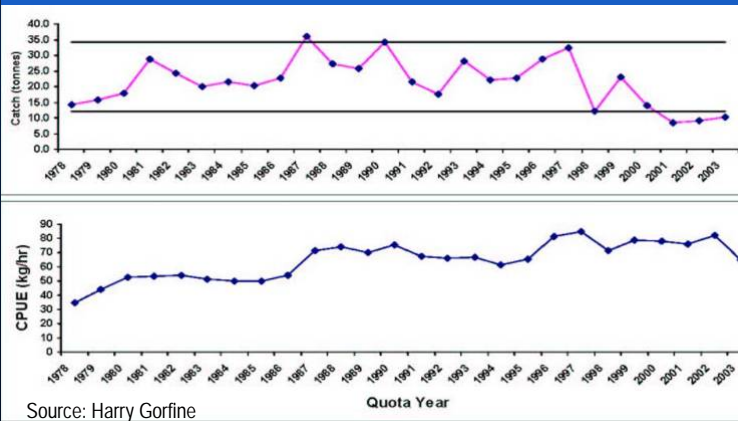


Reefcode Catch history

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➤ Interpreting catch history (pink below) is vital

- Is a decline due to depletion, or reduced effort on the reef?
- Is this an area far from the ramp? Weather limited?
- Do you scratch to find sized fish?
- Do bounces show stocks, or when other stocks were more/less good?



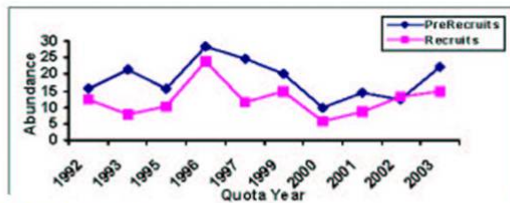
Catch/effort (CPUE) can help interpret catch history

Historically high (CPUE) and declining catch is bad news

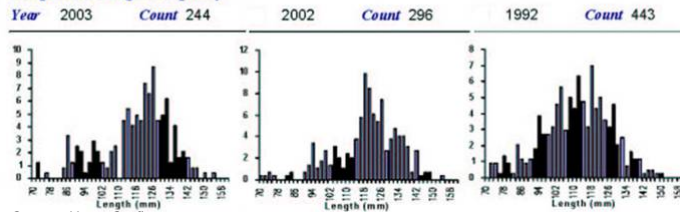
Surveys: what is on the bottom?

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- Annual surveys are available for some Vic. Reefs.
 - Abundance trends show relative numbers of sized (pink) and 'pre-recruits' (blue) that should grow over size soon. Declining pre-recruits is a warning. But the numbers bounce due to sampling



Independent Length Frequency



Source: Harry Gorfine

Length frequencies increase due to emergence, and show effects of fishing over larger sizes

They also show change over time

Prince's method to assess stocks

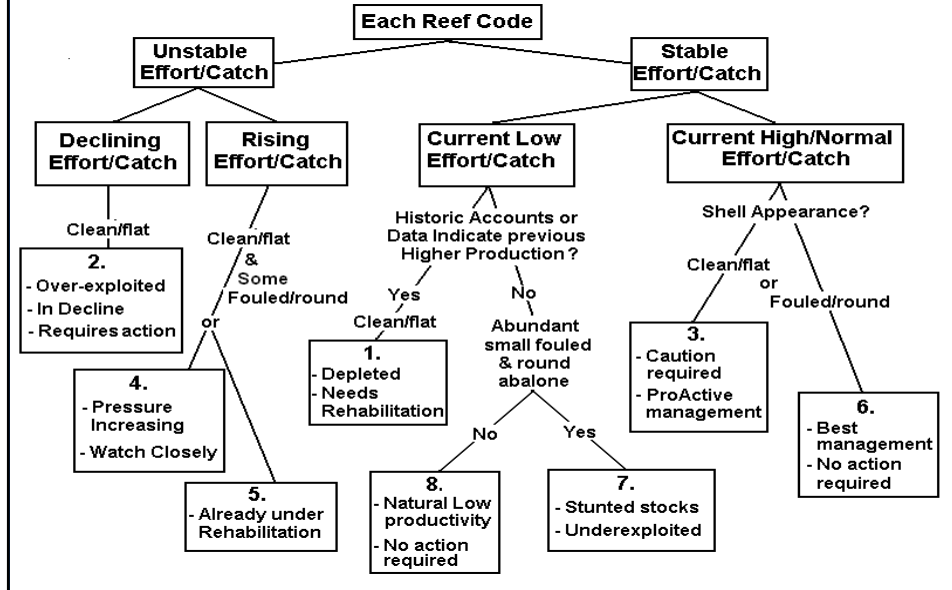
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- **Assessment process must be structured, disciplined and transparent.**
- A decision tree sets a structure to frame decisions
 - Use the tree as a basis to reach agreement
 - Use Catch Trends , plus Shell shape and Appearance
 - These principal criteria produce 8 Exploitation Categories.
 - Thus the basis for assessment of each area is transparent.

1. Effort or catch unstable or stable?
- DECIDE: 2. Declining/RisingHigh / Low?
3. Clean, Flat / Fouled, Domed?

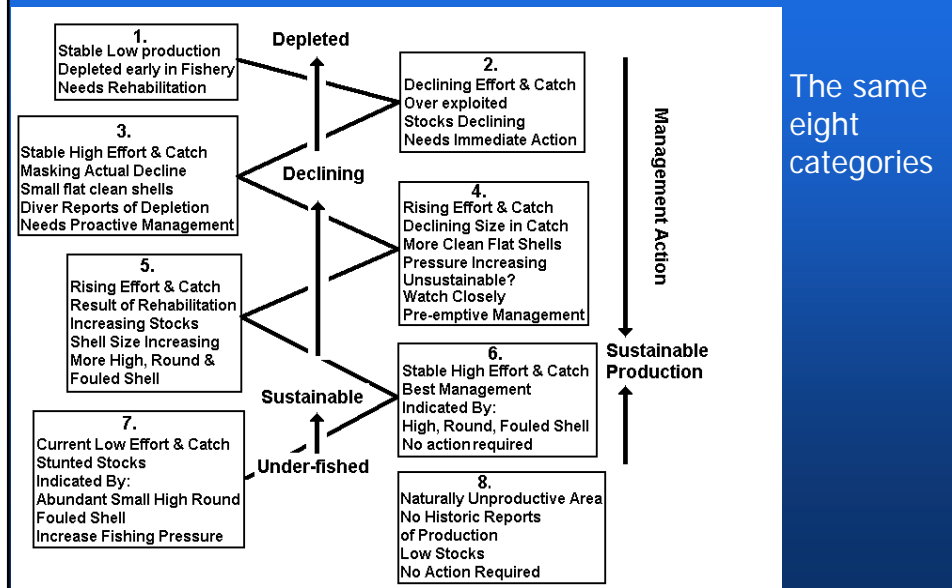
The Decision Tree

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Another view: Depletion / Rehabilitation of stocks

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The same eight categories

Industry FSM: Summary

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- Needed because recruits from local parents
- AND size of maturity differs, so local LMLs needed
 - To avoid serial depletion of most productive stocks
- Assessment can be based on catch history, plus shell Doming and Fouling
- A decision tree structures the decisions
 - and makes transparent the basis of assessment
- Setting size limits transfers effort
 - So reefcode catch caps also needed
- Higher LMLs raise weight/ab as well as egg output

WADA – Western Zone Vic.

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- 2002 First reef code voluntary MLs
- 2003 September – 1st Reef Assessment Workshop
 - Multiple reef code size limits
 - Target and Trigger limits to Manage Reef Code Catches
 - 8% TACC reduction requested
 - Research fishing to establish size of maturity on some reefs
 - Small Reseeding Trials
- 2004 October – 2nd Reef Assessment Workshop
 - Multiple MLs within Reef Codes by Code of Conduct
 - Further 17% TACC reduction
 - Rebuilding Goals: Last cut to TACC & back up by 2009.
- 2005 March – 1st Planning Workshop decisions
 1. concentrate TACC cut on areas with most rebuild potential
 2. close key areas, rather than disperse catch reductions.
- 2006 - Virus infections began
 - Reefcode targets used to react to loss of stocks



Photo: J Prince

VADA – Central Zone Vic.

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- 2002 First MOU to control Port Phillip Bay Catch Levels
- 2004 May - First Reef Assessment Workshop
 - Introduction to Reef Assessment Ideas
 - Initial Assessment of some Reef Codes
- 2004 October – Second Reef Assessment Workshop
 - First use of Voluntary Reef Code MLs
 - Target and Trigger limits for other Reef Codes managed through MOU
- 2005 October – Third Reef Assessment Workshop
 - Process continued and developed.....



Photo: Rob Day

Experience teaches us...

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- Raising size limits must be gradual..
 - To allow grow-through each year
- Both levers: Size limits and Catch caps need to be used together
 - The total quota must be based on what reefs can take
- Voluntary MLs cannot exceed Legal limits by much
 - Or someone will be too tempted to undercut
 - Collaboration with the State to vary LMLs in broad areas reduces this problem
 - Some kind of monitoring system helps
- Mixed size areas are the hardest to agree on
 - Once larger fish are reduced, areas appear stunted
- The more data you have, the less disagreement
 - Measuring machines, etc. have an unseen value in this respect.