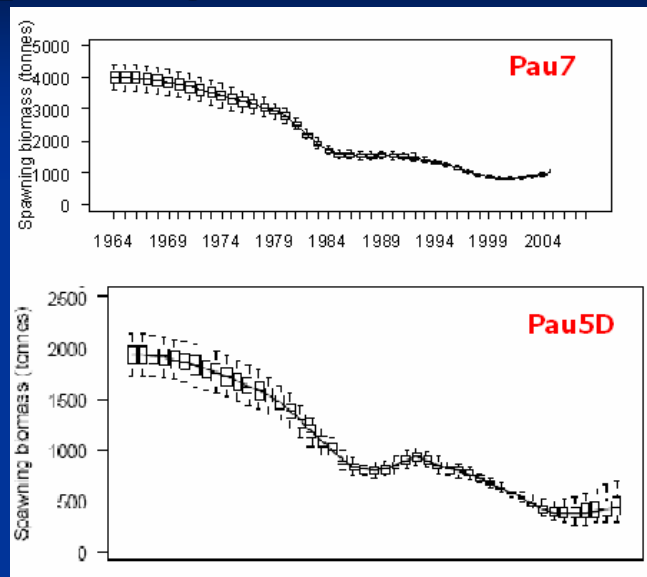


The Logic of RESEEDING

This presentation is about the correlation between the **removal** of fish from a population (fishing) versus the ability of the remaining population to **restock** itself.

Are we harvesting at a level that is greater than the populations ability to restock itself
or
as we harvest are we also removing some of the parent bio-mass each year (mining) to sustain our catches.

Spawning Biomass – Pau7 & 5D



25%

25%

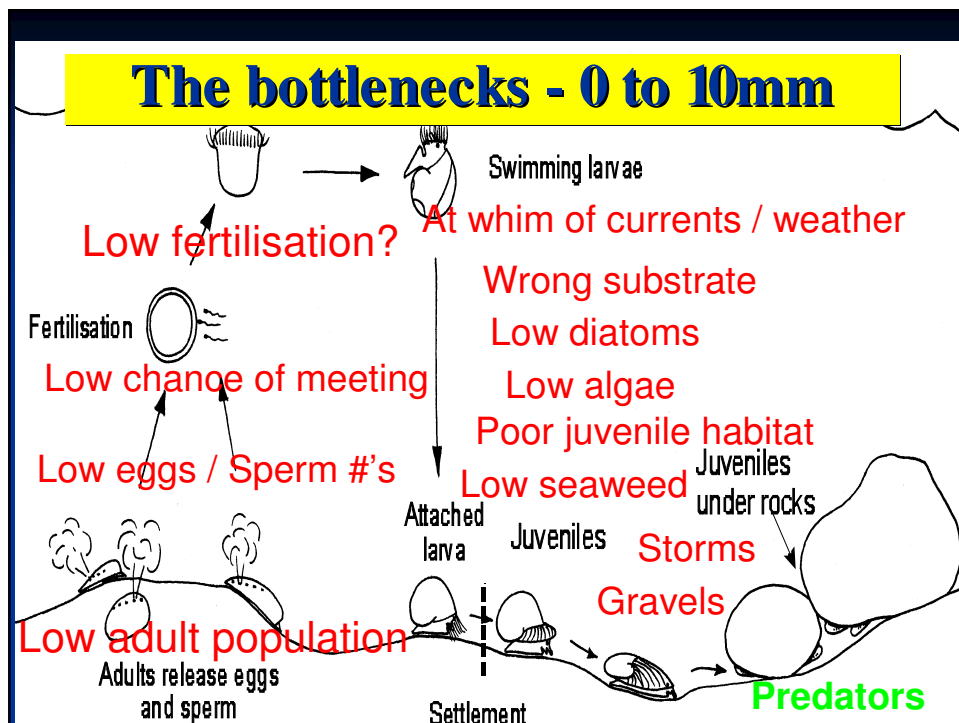
Species (plant, mammal, fish etc) that are slow growing, long living and which have low rates of fertility take many generations to recover from a reduction in population mass.

Paua are not unusual in this respect.

Recent analysis of 128 marine fish stocks revealed that only 3 species might be able to recover spontaneously from severe harvest-induced reductions (Meyers et al. 1995).

Paua are ancient snails (65M years) and their evolutionary stage is still in the dinosaur era. They are inefficient breeders, grazers and converters.

Their early lifecycle is hit and miss to say the least.



A slide presented by Rodney Roberts at the 2003
Paua Conference in Queenstown

What is survival in the wild?

- 1 female paua
 - 2 million eggs per spawn
 - 20 spawns per lifetime
 - 40 million eggs per female
 - Half are female, so 20 million eggs/ paua
- If population stable: **only one survivor** per 20 million eggs
- Survival in hatcheries is ~ **100,000** times higher
- ~ **100,000** needs updating to ~ **300,000**

1 Female Paua vs Hatch/ reseedling

		Attrition %	Mortality	Survivors	
Eggs	40,000,000	99%	39600000	400,000	
Fertilization	400,000	95%	380,000	20,000	
Swimming larvae	20,000	90%	180,00	2,000	
Settlement	2,000	85%	1,700	300	
2mm	300	80%	240	60	
5mm	60	75%	45	15	
10mm	15	60%	9	6	4,750,000
30mm	6	50%	3	3	1,900,000
50mm	3	20%	.60	2.40	950,000
90mm	2.40	10%	0.24	2.16	760,000
125mm	2.16				684,000

When it comes to the number of progeny per parent, pua and humans are similar

- **The NZ 1996 Census showed average of 1.87 children/ women.**
- **rodney Roberts slide showed just over 2 pua per female over their lifetime.**

When it comes to the number of progeny per parent, pua and humans are similar

- **The NZ 1996 Census showed average of 1.87 children/ women.**
- **rodney Roberts slide showed just over 2 pua per female over their lifetime.**

Therefore humans have **just under 1** offspring per adult (**mum & dad and 1.87 kids**)

Therefore pua have **just over 1** offspring per adult (**mum & dad and 2.16 off-spring**).

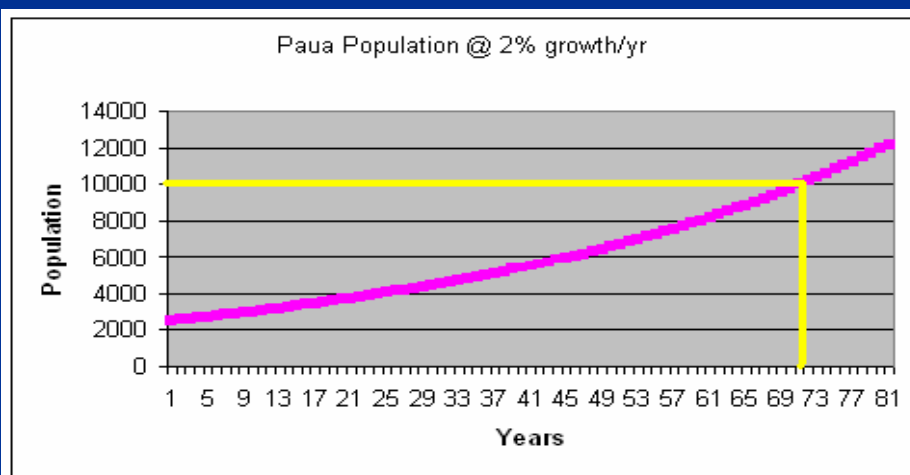
Throughout the 1960s, the world's human population was growing at a rate of about 2% per year.

By 1990, that rate was down to 1.5%, and by the year 2015, it's expected to drop to 1%.

Lets use a growth rate of 2% for our Paua population

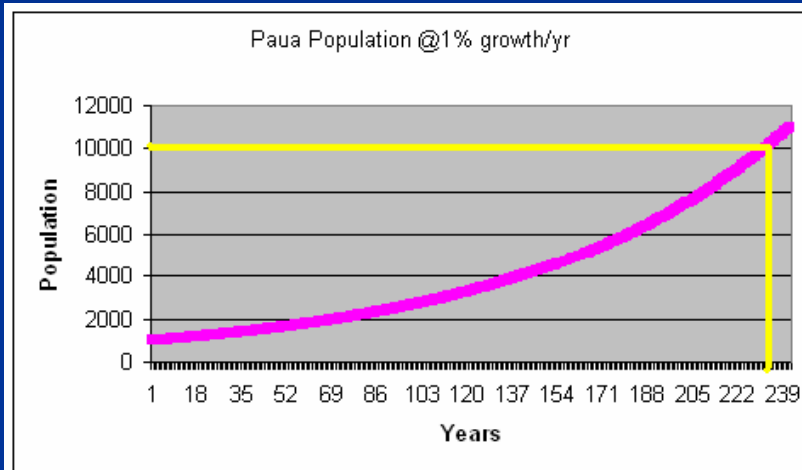
Exponential growth model

Spawning biomass @ 25% (2,500) of original numbers (10,000) with 5% mortality and 7% increase / yr = 2% growth **Remember = No Fishing / Closed area**



Exponential growth model

Spawning biomass @ **10%** (1,000) of original numbers (10,000) with 5% mortality and 6.08% increase / yr = **1%** growth **Remember = No Fishing / Closed area**



There is no rocket science here.

In the previous examples **there was no fishing occurring.**

If you want to fish as well and the harvest rate is at a greater rate than the populations growth rate (1 to 2%) then the population will always be reducing.

Rebuilding locally depleted areas at a faster rate could involve:

- 1 - hope for a **large spawning** (<75%),
- 2 – **translocate** from other beds (<75%)
- 3 - bring in juveniles (independent of the fishery) = **reseeding**.

This exercise is based on theoretical numbers - there is always the chance that a large spawning / better recruitment could occur.

However the abalone fisheries in California (2400t), Canada, Korea (2400t), Chile (24000t) were still waiting as the last commercial abalone came out of these fisheries.

Lets not wait

To reseed or not to reseed

1. If you have areas of large juvenile & adult numbers = little point in reseeded.
2. Areas of high adult numbers but low juveniles numbers = reseeded plus increasing the MLS.
3. Areas of localised depletion = reseeded is the only viable option.

If reseeded doesn't form the backbone of our future management plans for areas suffering from localised depletion then we will never in our life times rebuild paua stocks to past levels.