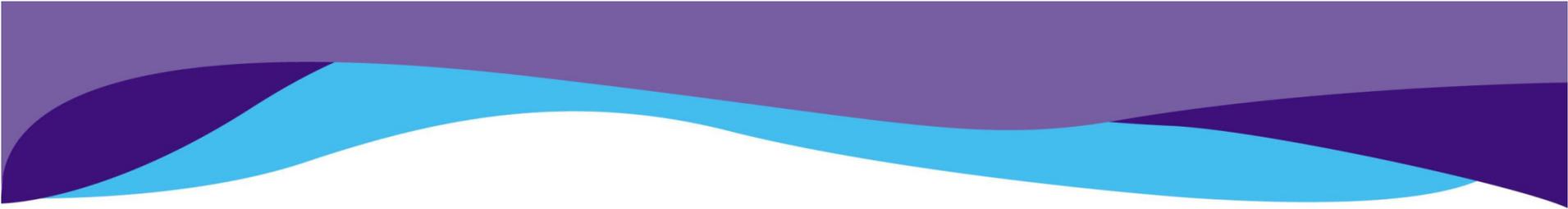


Fishmeal and fish oil production and its role in sustainable aquaculture 1

Dr Andrew Jackson

Technical Director
International Fishmeal & Fish Oil Organisation





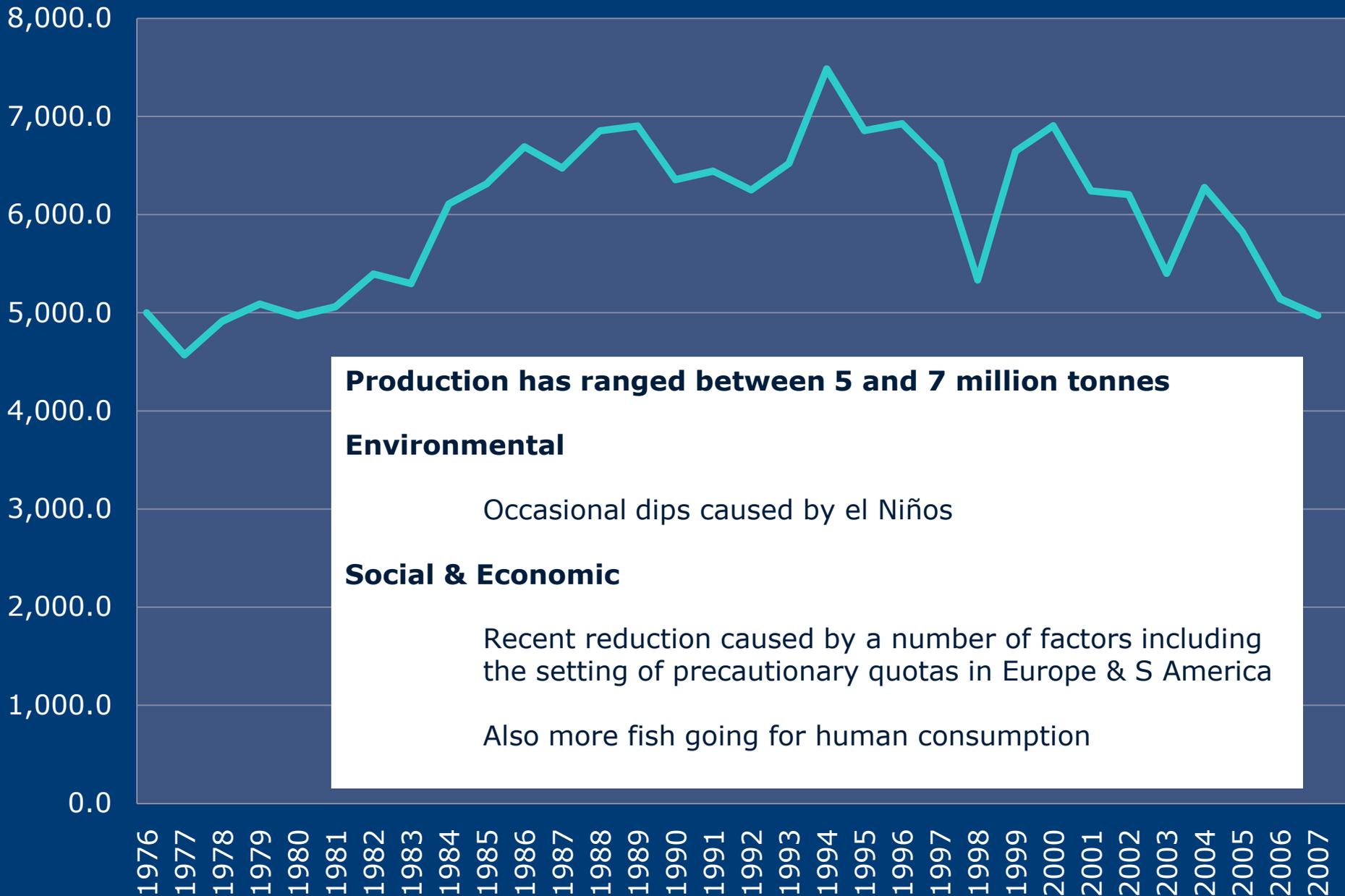
Refuting the myths:

No 1

Fishmeal is NOT getting scarce



Fishmeal Production 1976-2007 ,000 tonnes



Production has ranged between 5 and 7 million tonnes

Environmental

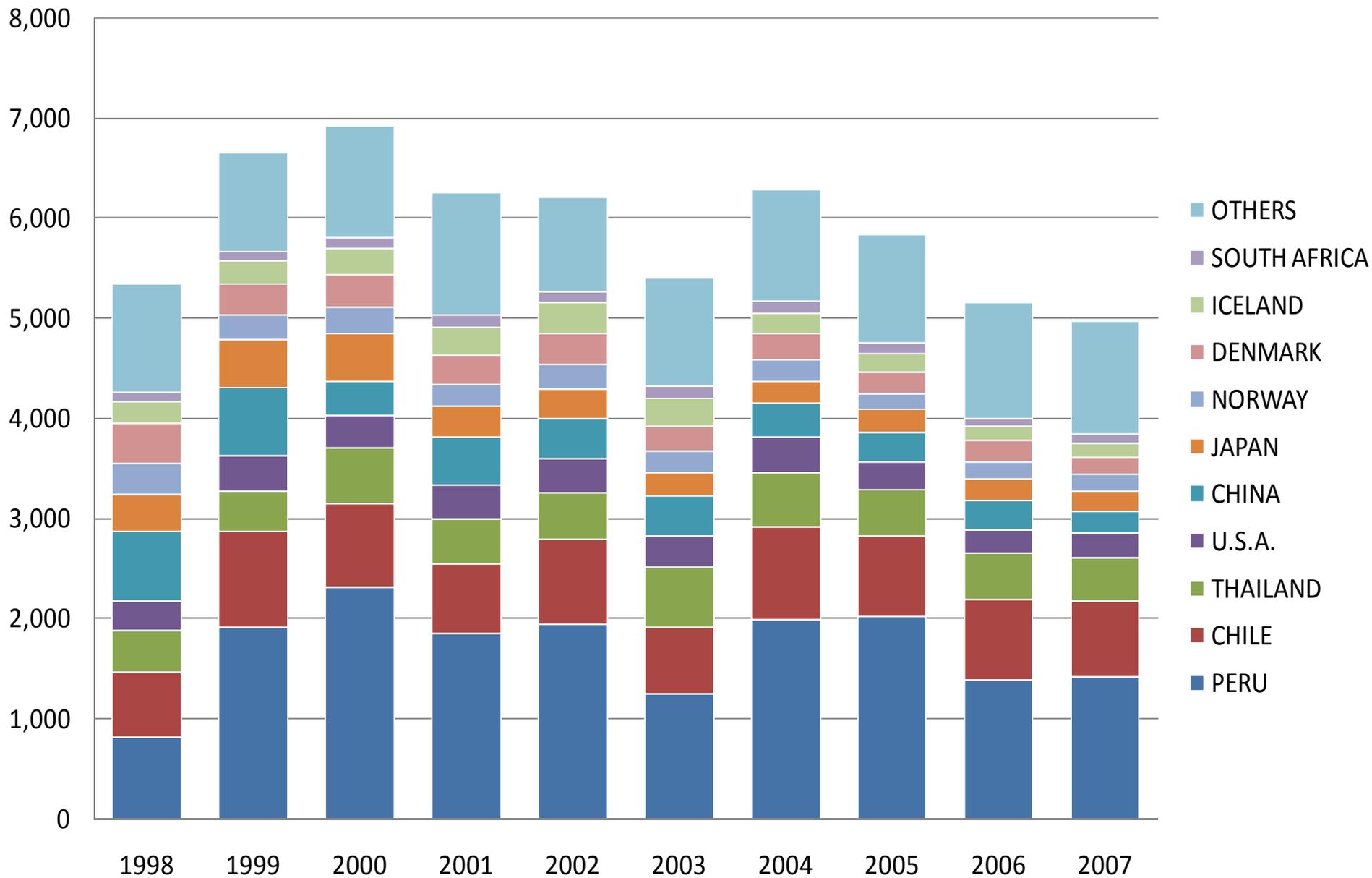
Occasional dips caused by el Niños

Social & Economic

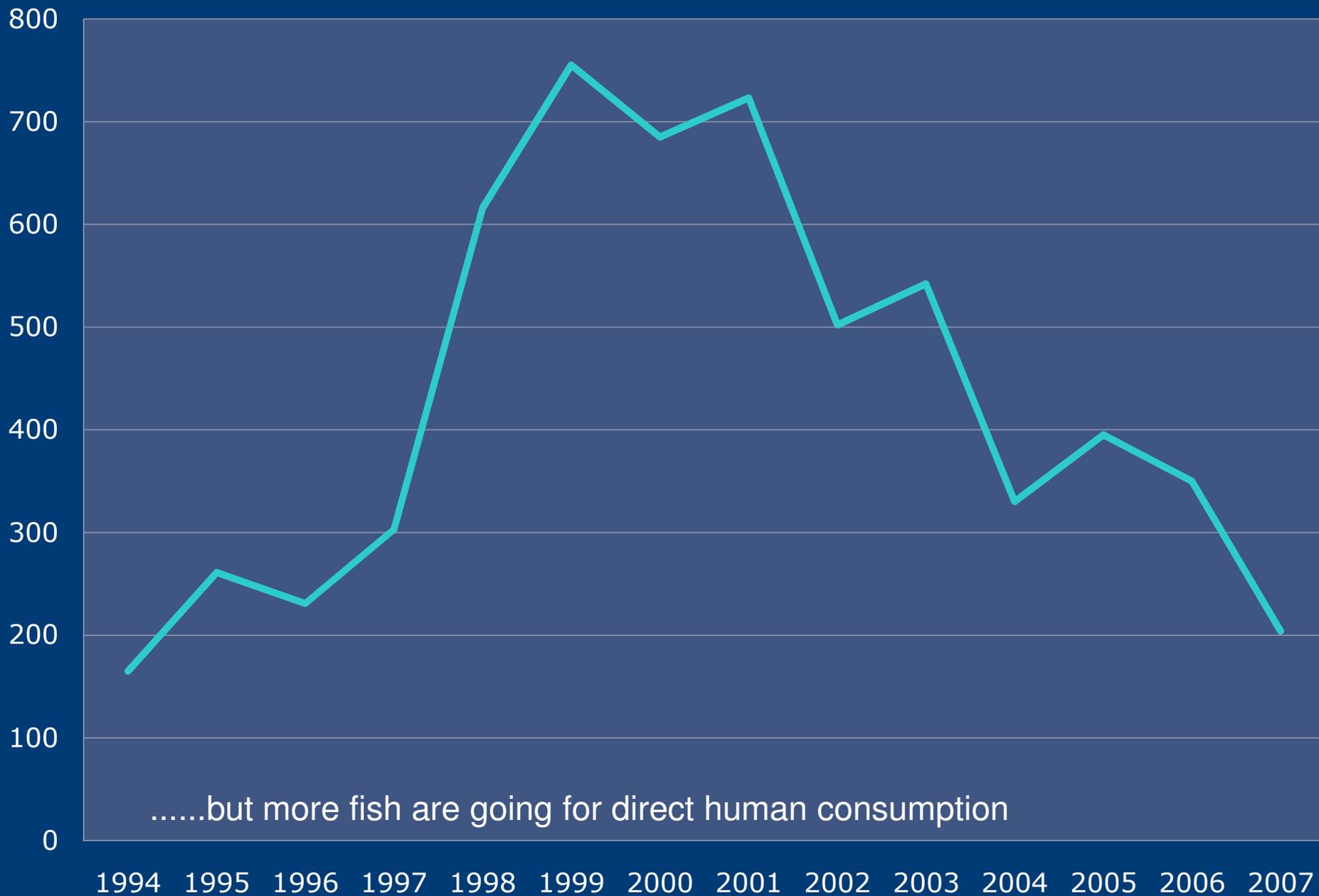
Recent reduction caused by a number of factors including the setting of precautionary quotas in Europe & S America

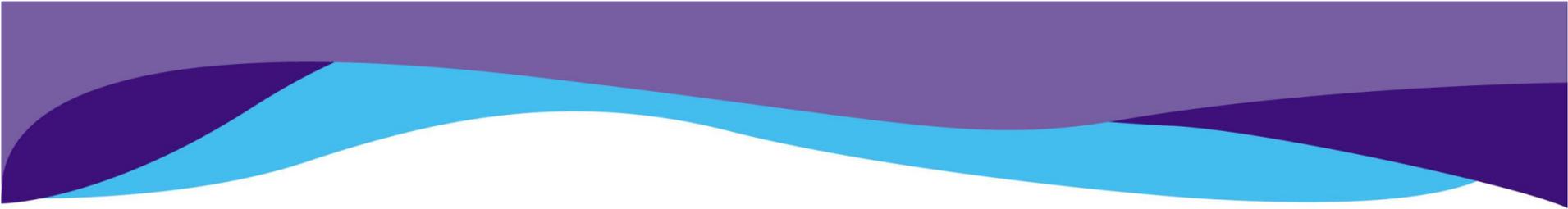
Also more fish going for human consumption

World Fishmeal Production by country 1998-2007 ,000 tonnes



Chinese Fishmeal Production 1994-2007 tonnes ,000





Trends in production

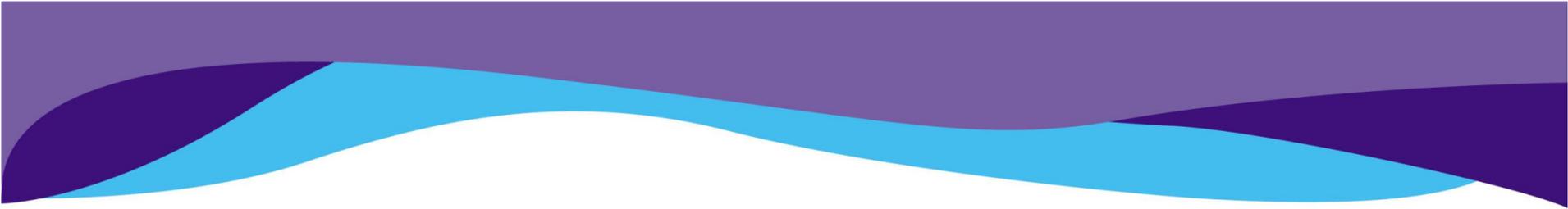
Long-Term relatively constant with periodic El Niños

Tightening supplies in recent years due to a combination of :

- Ω Precautionary quota setting
- Ω Increased use for human consumption e.g. over 50% Chilean Jack mackerel go for freezing/canning
- Ω Climate changes and fishery changes
- Ω Poor fisheries management in some countries

Hopefully the precautionary quota setting will allow increased quotas in the future with a return to Maximum Sustainable Yields e.g. EU





Refuting the myths:

No 2

The production of fishmeal is NOT at
the cost of human food

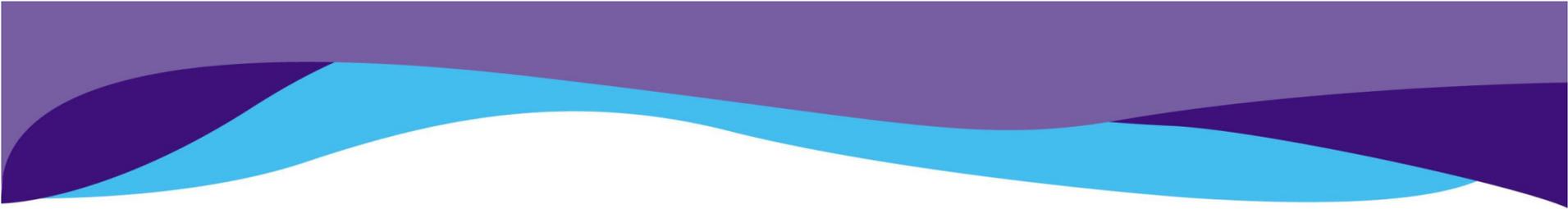




Fishmeal v Human Food

- Ω Nearly 25% of fishmeal comes from fisheries by-products – this is growing every year
- Ω In most cases wherever possible the fish will be sold for human food – it pays more money (jack mackerel, herring, blue whiting etc)
- Ω There are major efforts being made with Peruvian Anchovy to use it for human food both within Peru and for exports
- Ω Fish Oil , the best source of EPA & DHA, is increasingly being used for direct human consumption





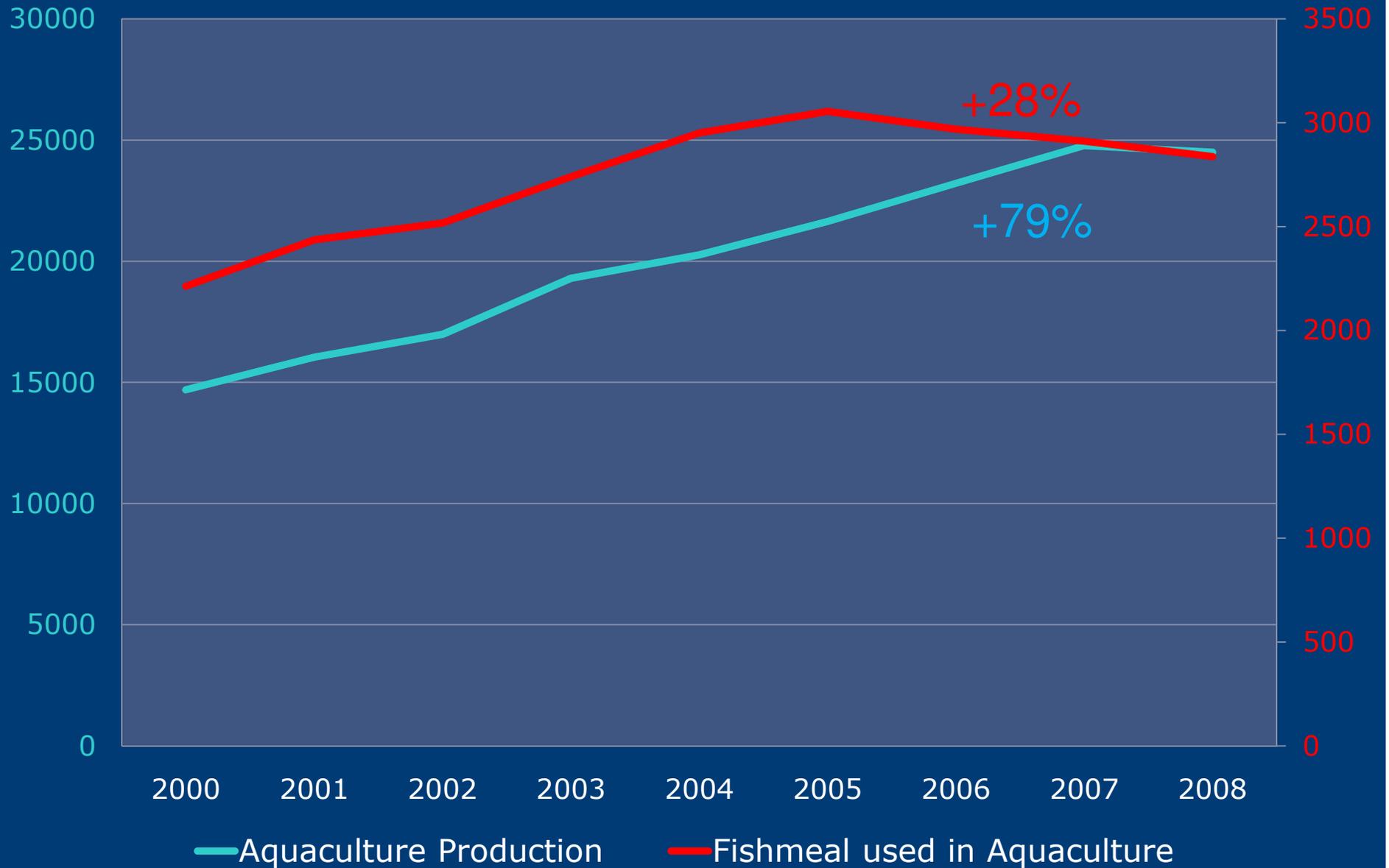
Refuting the myths:

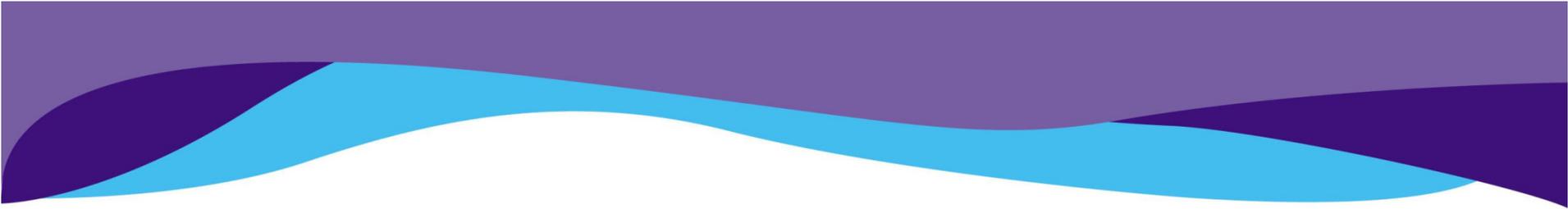
No 3

Aquaculture CAN grow even if there
is no more fishmeal



World Fed Aquaculture Production & Fishmeal usage in Aquaculture 2000-2008 ,000 tonnes





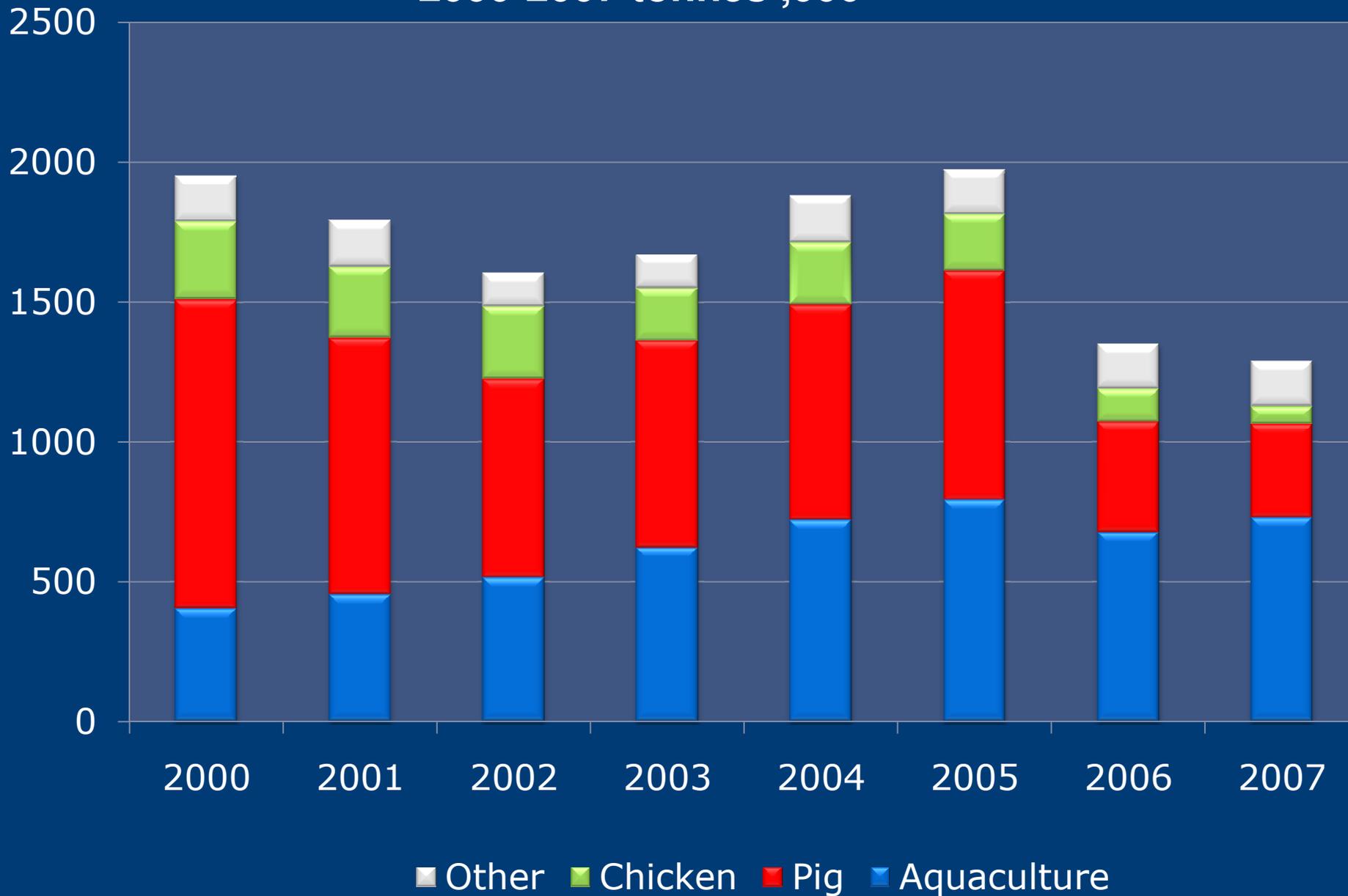
Growth in fishmeal usage limited by:

- Ω Price elasticity for the different segments – carp most elastic , eels least elastic
- Ω Market forces, technology and nutritional knowledge have driven substitution
- Ω But the growth of aquaculture has not been limited by the availability of fishmeal

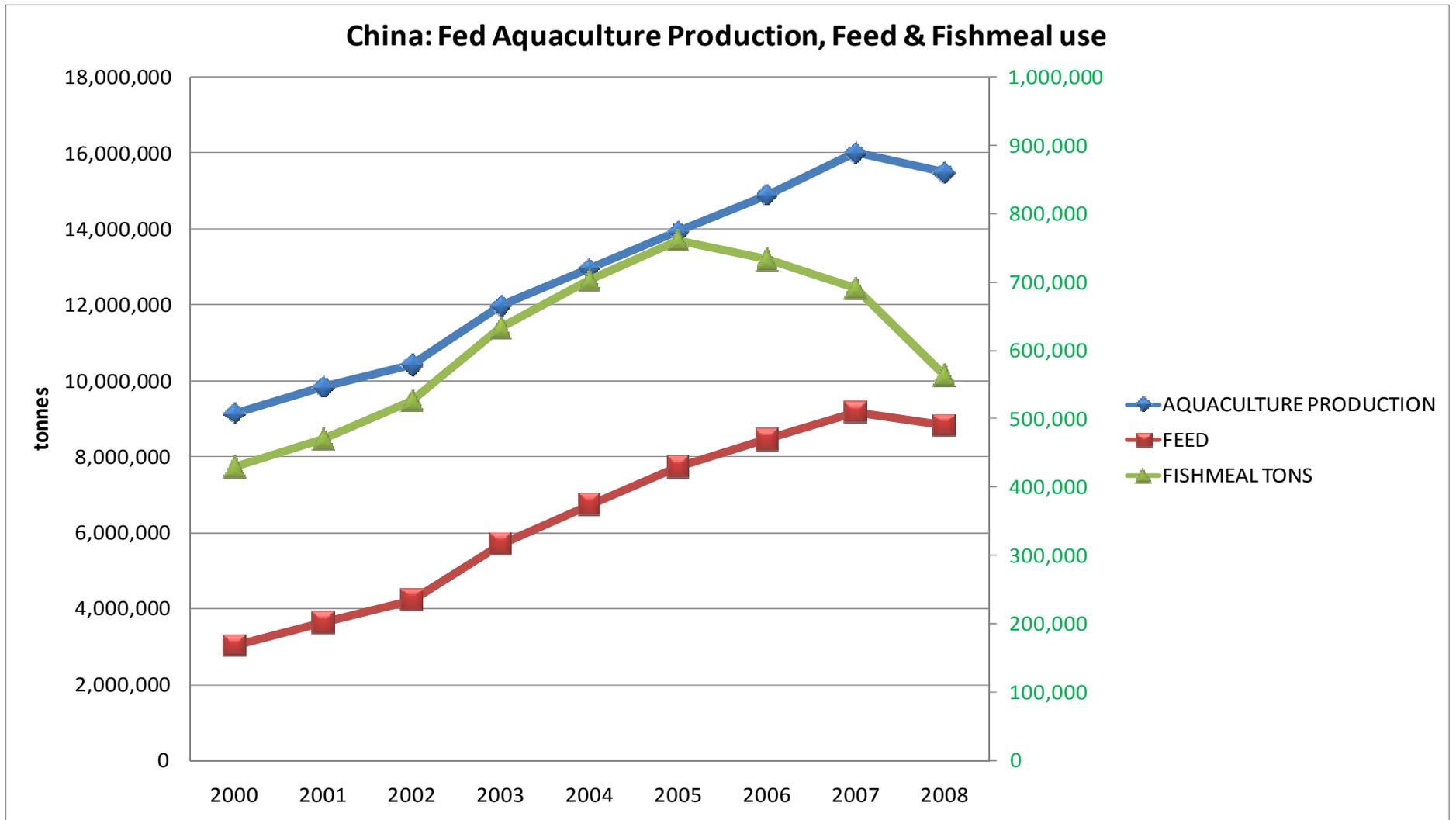
China the world's largest fishmeal user consumed less fishmeal in '07 than it had for a decade

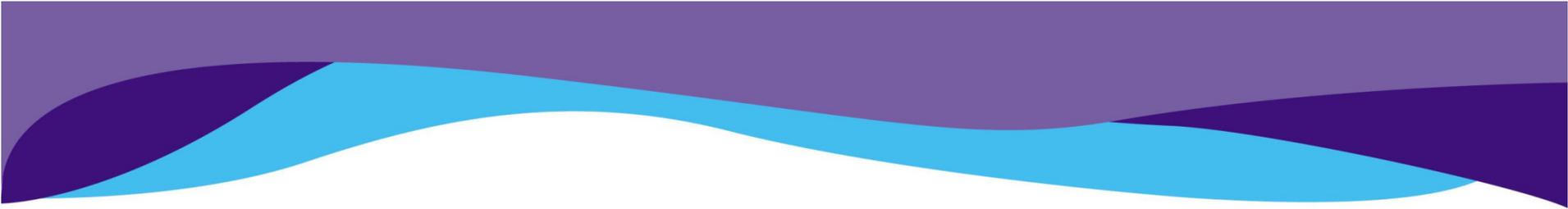


China Fishmeal Usage 2000-2007 tonnes ,000



Growth in Chinese Aquaculture not dependent on fishmeal





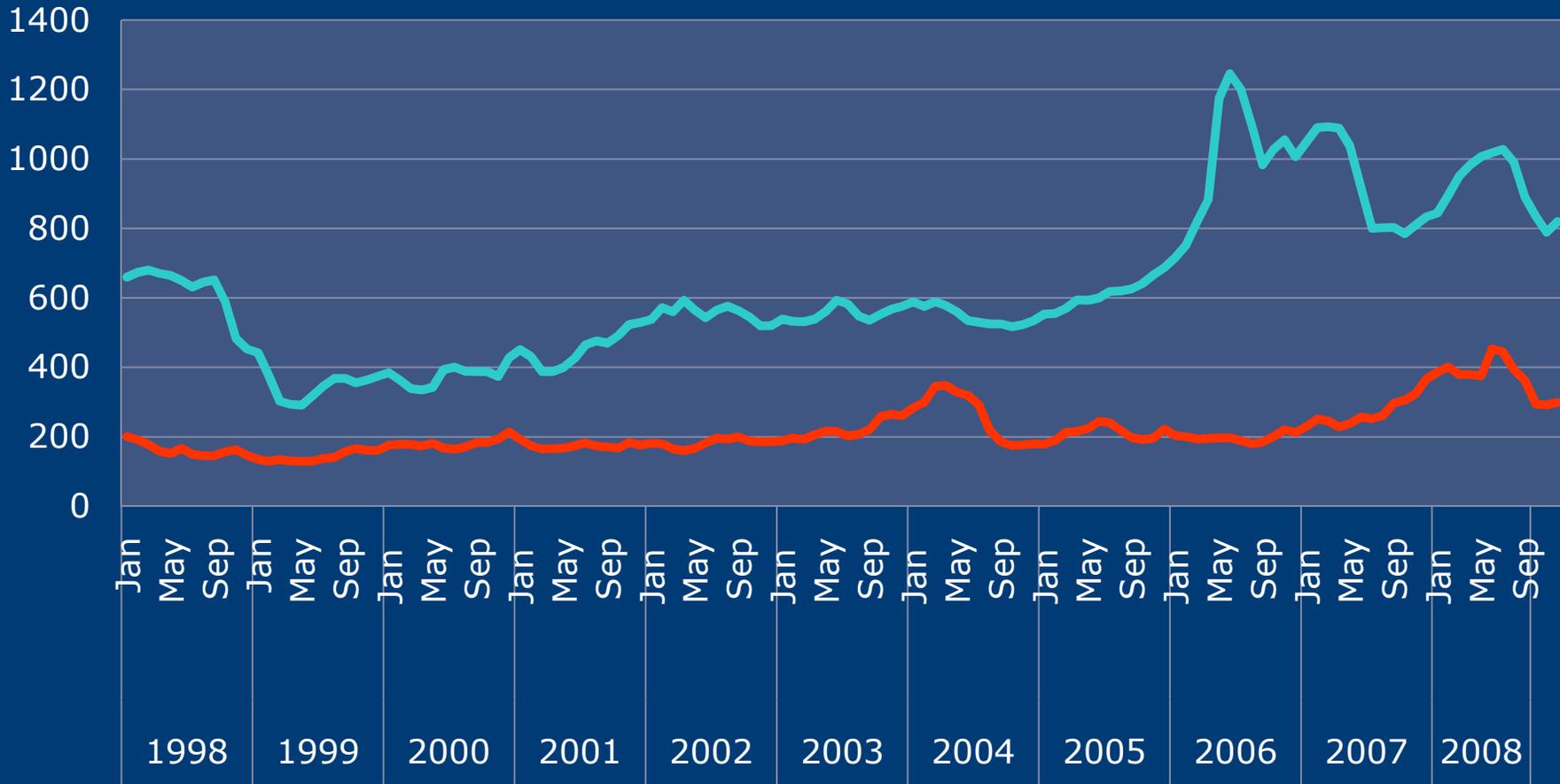
Refuting the myths:

No 4

Fishmeal is NOT getting so expensive it is limiting aquaculture growth



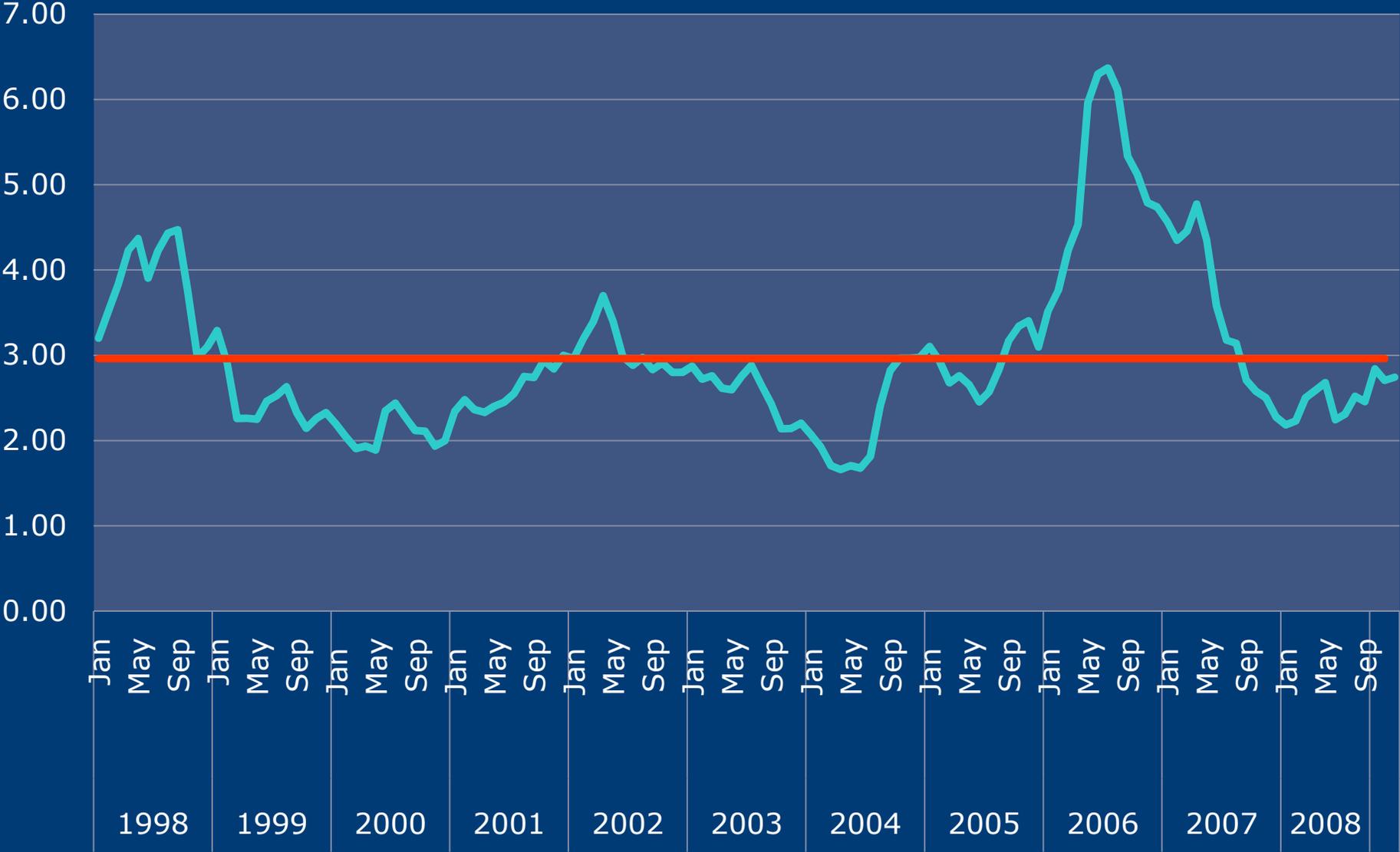
Fishmeal & Soymeal Prices 1998-2008 US\$/tonne



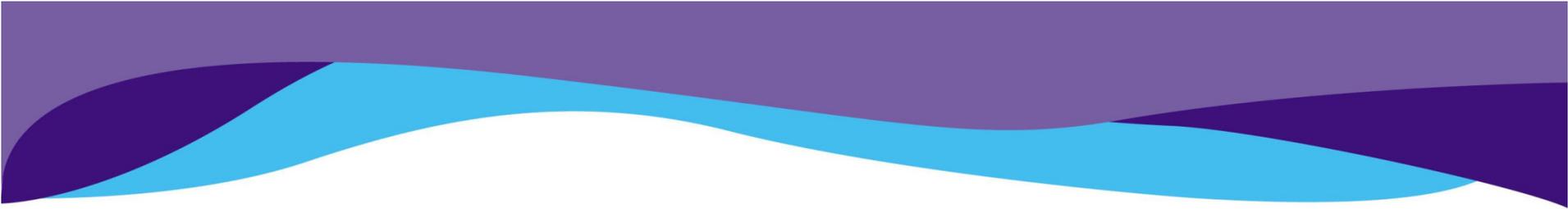
— Fishmeal Price monthly FOB Peru

— Soymeal Price Monthly FOB Brazil

Fishmeal to Soymeal Ratio 1998-2008



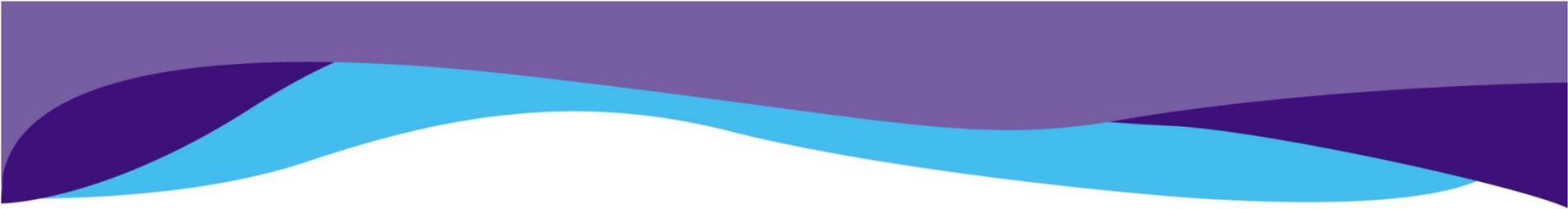
— - Average over 11 years



Summary: Fishmeal & the growth of aquaculture

- Ω The availability & price of fishmeal has not been a limiting factor in aquaculture growth to date
- Ω Fishmeal supplies are likely to remain tight but stable into the future except in el Niño years
- Ω Improved processing technology will make better vegetable proteins available
- Ω This combined with improving nutritional knowledge will allow lower dietary inclusion levels as feed volumes grow
- Ω Fishmeal will increasingly become a strategic ingredient in specialist diets such as starter, broodstock and finisher diets





Refuting the myths:

No 5

Fishmeal's conversion efficiency
has been drastically UNDER
calculated



Eco-conversion in aquaculture

- Ω Many different numbers are used on how many kilos of wild fish it takes to produce a kilo of farmed fish
- Ω Salmon in particular have come under scrutiny with ratios as high as 10:1
- Ω Tacon (2008) most recently gave a figure of 4.9:1



Contents lists available at ScienceDirect

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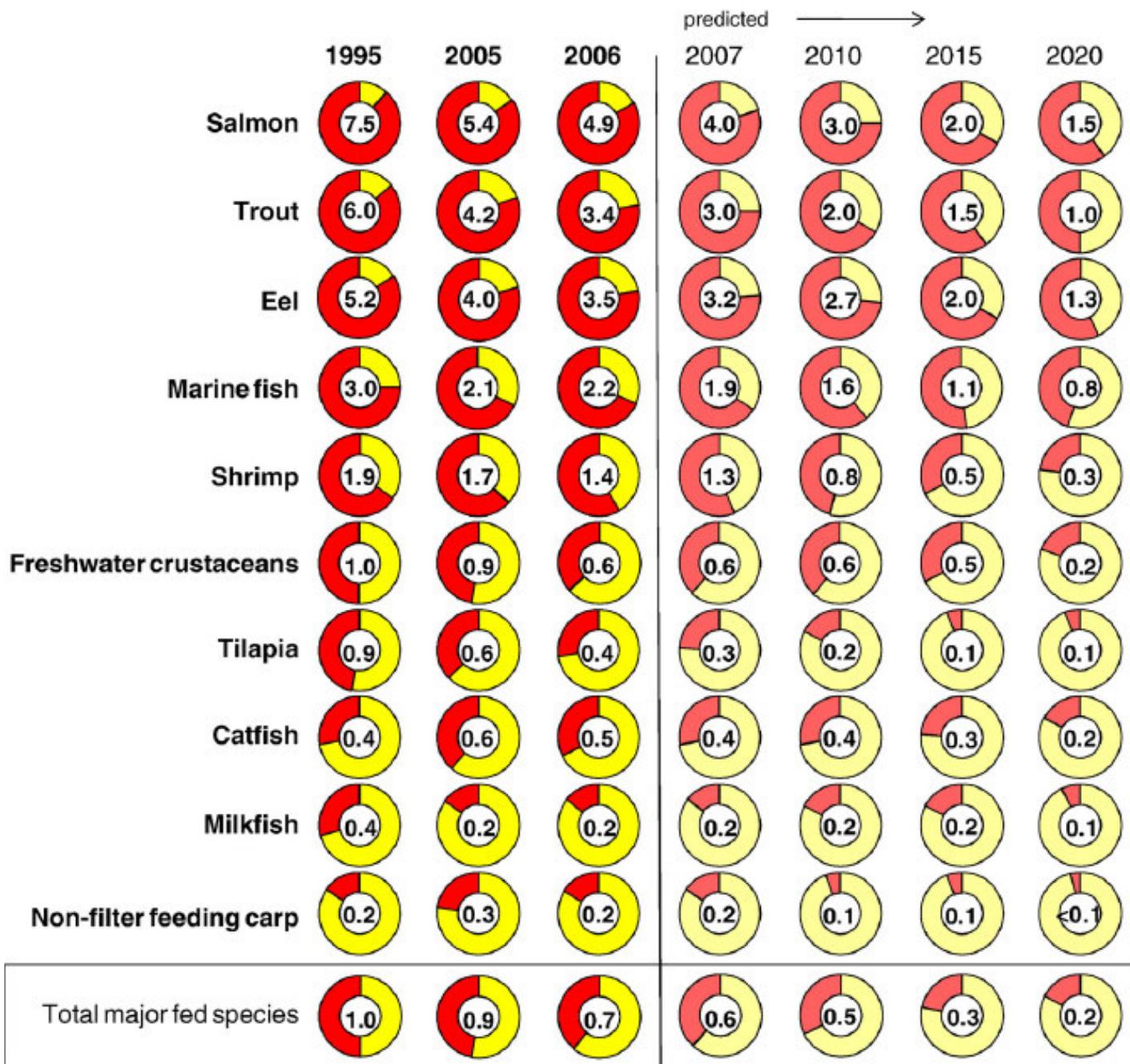


Global overview on the use of fish meal and fish oil in industrially compounded aquafeeds: Trends and future prospects

Albert G.J. Tacon ^{a,*}, Marc Metian ^b

^a Aquatic Farms Ltd, 49-139 Kamehameha Hwy, Kaneohe, HI 96744, USA

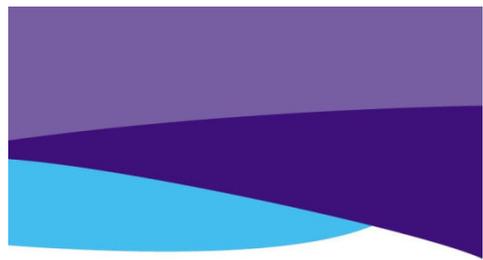
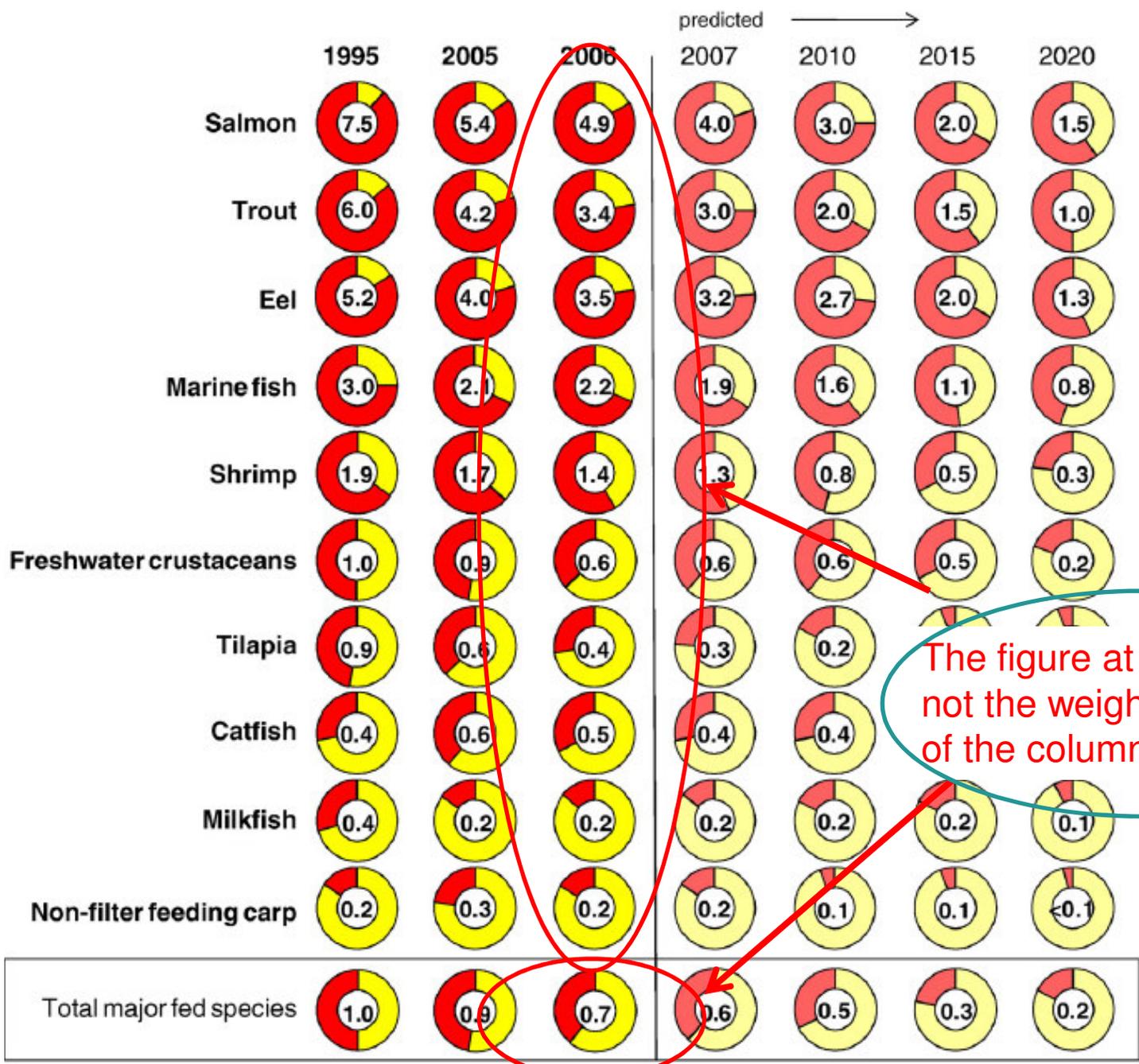
^b Hawaii Institute of Marine Biology, University of Hawaii, Kaneohe, P.O. Box 1346, Kaneohe, HI 96744, USA



Tacon 2008:
Table of Eco-
efficiency & Fish –
In-Fish-Out Ratios



 Transfer coefficient
  Annual production (tonnes)
  Pelagic forage fish equivalent (tonnes)



Tacon 2008:
Table of Eco-
efficiency & Fish –
In-Fish-Out Ratios

The figure at the bottom is not the weighted average of the column

 Transfer coefficient
  Annual production (tonnes)
  Pelagic forage fish equivalent (tonnes)



SALMON

Wt of pelagic fish at start kg	1000
Wt of Fishmeal kg	225
Wt of fish oil kg	50
How much salmon do I produce?	
Fish oil in the diet %	20
Fishmeal in the diet %	30
Requirement of oil kg	50
Requirement of fishmeal kg	75
Amount of feed that can be produced kg	250
FCR	1.25
Salmon Produced kg	200
FIFO	5.0
Fishmeal left over kg	150

FIFO Ratio for Salmon using the method by Tacon 2008 :
Using 2006 assumptions



Assumptions from Tacon & Metian highlighted

SALMON	PLUS	SHRIMP	PLUS
Wt of pelagic fish at start kg	1000		
Wt of Fishmeal kg	225		
Wt of fish oil kg	50		
How much salmon do I produce?		How much shrimp do I produce?	
Fish oil in the diet %	20	Fish oil in the diet %	2
Fishmeal in the diet %	30	Fishmeal in the diet %	20
Requirement of oil kg	35	Requirement of oil kg	15
Requirement of fishmeal kg	53	Requirement of fishmeal kg	150
Amount of feed that can be produced kg	175	Amount of feed that can be produced kg	750
FCR	1.25	FCR	1.7
Salmon Produced kg	140	Shrimp Produced kg	441

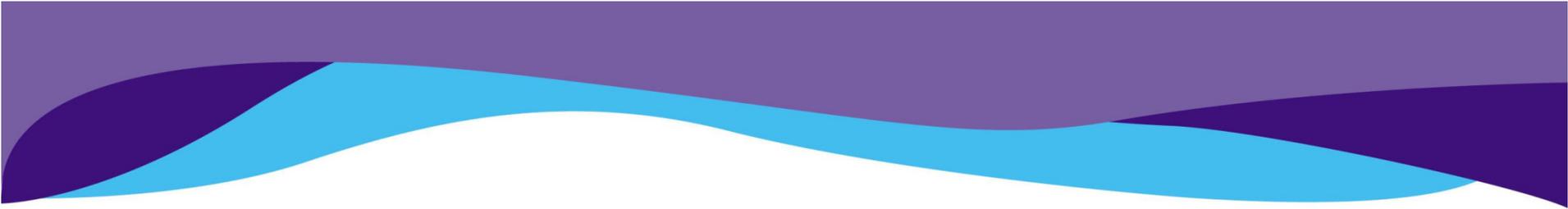


CARP

How much carp do I produce?	
Fish oil in the diet %	0
Fishmeal in the diet %	5
Requirement of oil kg	0
Requirement of fishmeal kg	23
Amount of feed that can be produced kg	450
FCR	1.8
Carp Produced kg	250

Total Weight of fish Produced	831
FIFO	1.2
Fish Oil left over kg	0
Fishmeal left over kg	0





A new formula for calculating FIFO ratios:

$$\text{FIFO Ratio} = \frac{\text{Level of fishmeal in the diet} + \text{Level of fish oil in the diet}}{\text{Yield of fishmeal from wild fish} + \text{Yield of fish oil from wild fish}} \times \text{FCR}$$

So using this formula we can calculate for salmon the following:

$$\text{Salmon FIFO Ratio} = \frac{30 + 20}{22.5 + 5.0} \times 1.25 = 2.27$$

So if we go back to our worked example.....



FIFOs in the worked example:

	Salmon	Shrimp	Carp
FIFO calculated using formula	2.27	1.36	0.33
Total of farmed production kg	140	441	250
Amount of wild fish used kg (Production x FIFO)	318	600	82
Total amount of wild fish used kg	1000		

This has been using Tacon's assumptions but the efficiency of fishmeal production has increased from a yield of 22.5% to 24%



If we now look at the global fishmeal picture we get the following:

Summary of FIFO Ratios as calculated by IFFO

Species	FM in Diet %	FO in Diet %	Yield of FM from wild fish %	Yield of FO from wild fish %	FIFO Ratio	Wild Fish used ,000 t
Salmon	30	20	24	5	2.2	3157
Trout	30	15	24	5	1.9	1226
Eel	55	5	24	5	2.9	784
Marine Fish	32	8	24	5	1.9	2858
Shrimp	20	2	24	5	1.2	3754
FW Crustaceans	15	1.5	24	5	0.5	586
Tilapia	6	0.5	24	5	0.3	718
Catfish	10	1.7	24	5	0.4	777
Milkfish	3	1	24	5	0.1	65
Carp	5	0	24	5	0.1	1460
Misc FW Carn. Fish	40	5	24	5	0.5	386
Total of Fed farmed fish & shellfish					0.66	15770
Pigs	0.25	0	24	5	0.03	4748
Poultry	0.3	0	24	5	0.02	1577
Total					0.09	22096

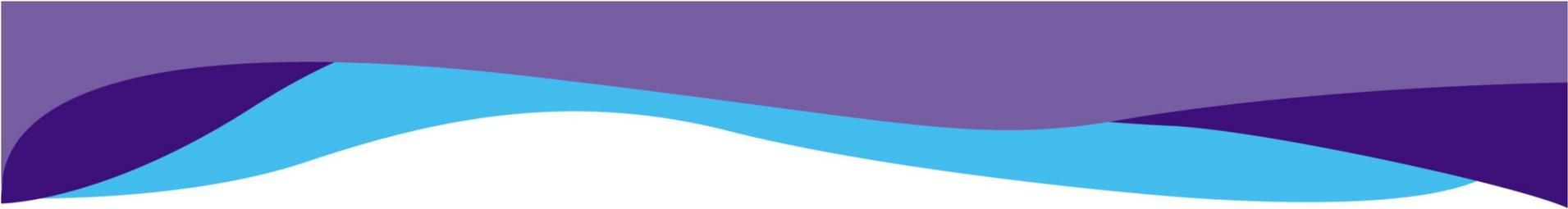
So it takes 90kg of fish to produce 1000kg of product

However 22% of fishmeal comes from fisheries by-products therefore:

Table showing the calculated FIFO for Aquaculture, Pigs and Poultry

	World Production ,000 t	Use of Fish ,000 t	% Coming from fishery by- products	Use of whole wild fish ,000 t	FIFO /FIPO
Aquaculture	23851	15770	22	12301	0.52
Pigs	141222	4748	22	3703	0.03
Poultry	76245	1577	22	1230	0.02
Total	241318	22096	22	17235	0.07
Salmon	1465	3157	22	2462	1.68





Conclusions on eco-conversion

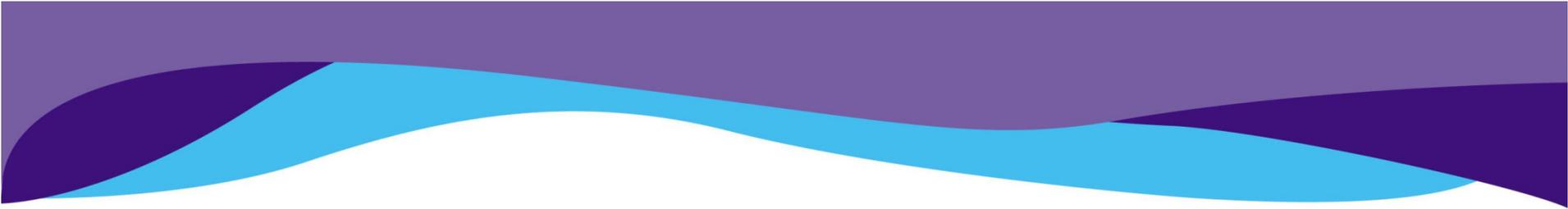
- Ω The Ratio for farmed salmon is not 10:1, not 5:1 but 1.7:1 and falling
- Ω The ratio for all fed aquaculture is 0.5:1 and falling
- Ω The ratio for all animal production using fishmeal is 0.07 and falling

For every 1 tonne of whole fish caught 14 tonnes of livestock is produced



But are the whole-fish used to make fishmeal from sustainable sources?



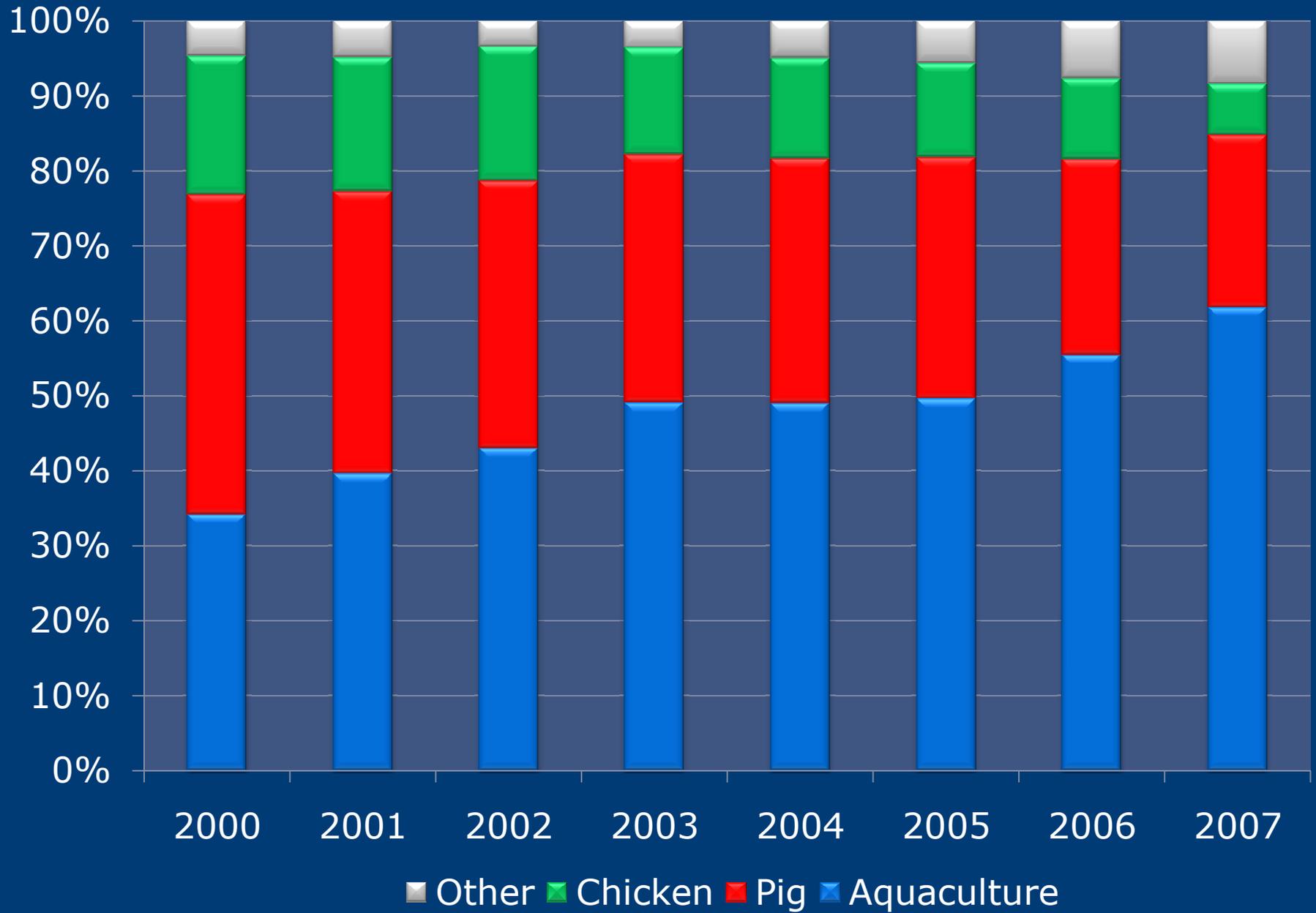


IFFO Responsible Supply Code

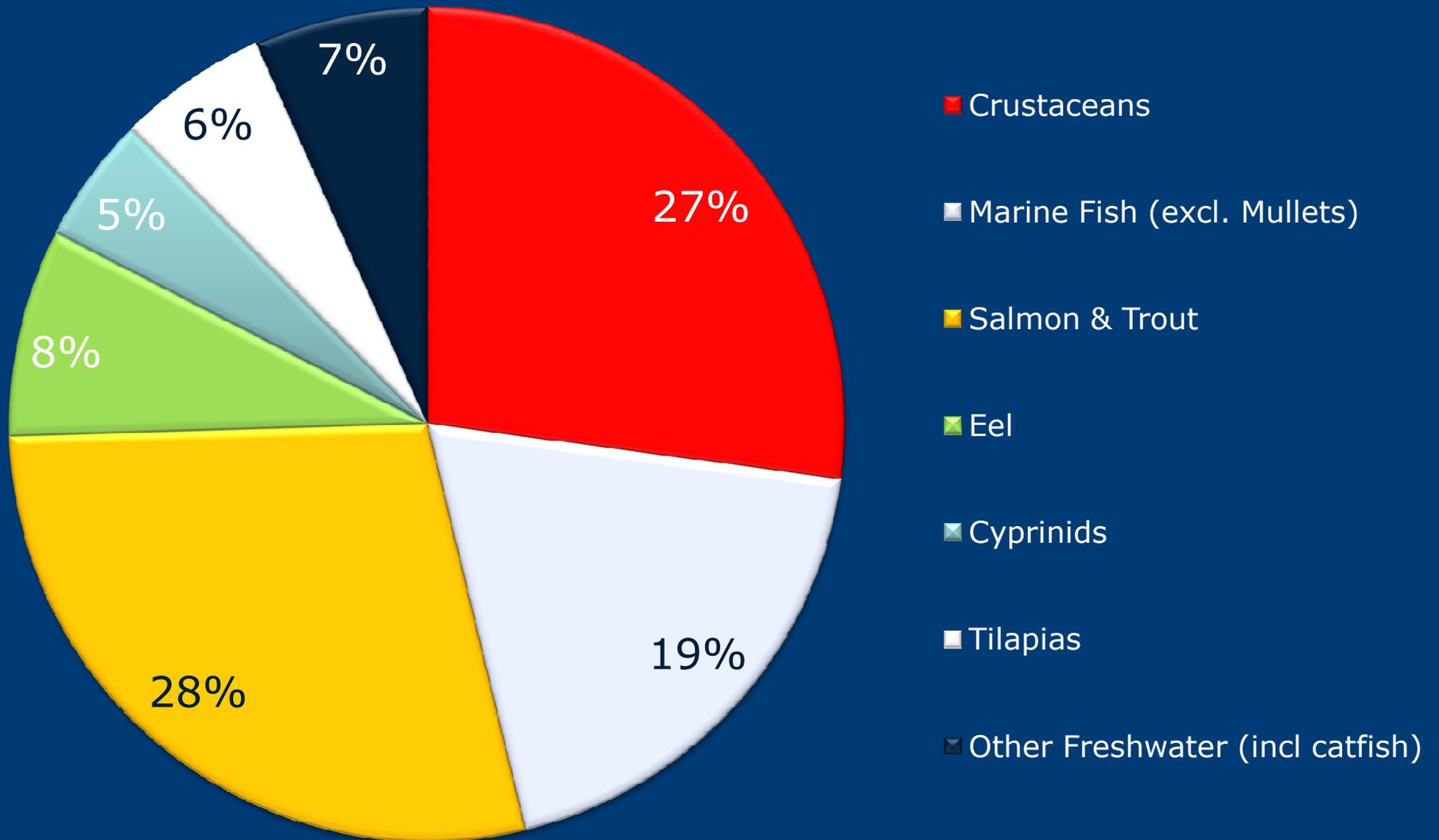
- Ω The two most critical factors that the value chain are concerned about are:
 - Responsible sourcing of the Raw Material
 - Purity and Safety of the product
- Ω IFFO is therefore working with other stakeholders to develop a third-party verified business-to-business scheme
- Ω I will be going into detail on this tomorrow at the workshop at 11 am

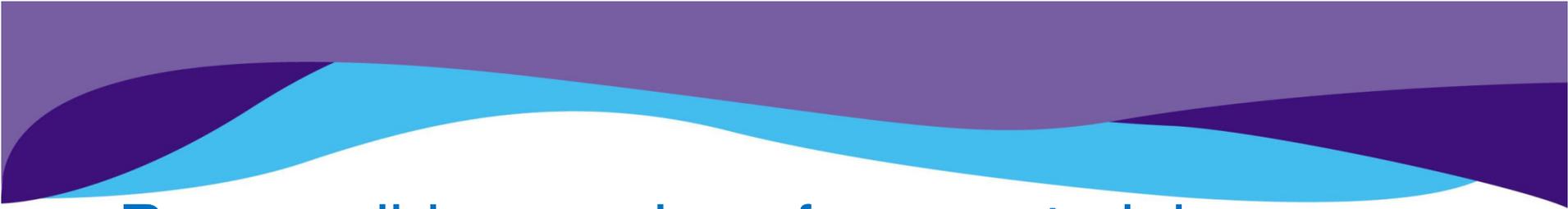


Change in Percentage Fishmeal Use



Fishmeal Usage in Aquaculture 2007





Responsible sourcing of raw materials

- Ω The Sustainability Movement is here to stay
- Ω Aquaculture needs to show that it is “sustainable” over the long-term
- Ω All feed ingredients whether fishmeal or fish oil or vegetable protein or oil need to be from sustainable sources
- Ω The fishmeal industry is continuing in conjunction with governments to do a lot to ensure that it is behaving responsibly
- Ω It needs to be able to demonstrate the different measures taken regarding responsible sourcing using third-party verification



Responsible sourcing of raw materials

- Ω The majority of fishmeal comes from countries that comply with the key elements of the UN FAO Code of Conduct for Responsible Fishing
- Ω The industry has to demonstrate this with independent verification
- Ω Fishmeal has suffered from accusations of being adulterated with land-animal proteins and protein boosters
- Ω IFFO has decided to develop its own Code of Conduct that covers responsible raw material sourcing and production
- Ω This is a B-to B scheme (not an eco-label) to allow the value chain to differentiate



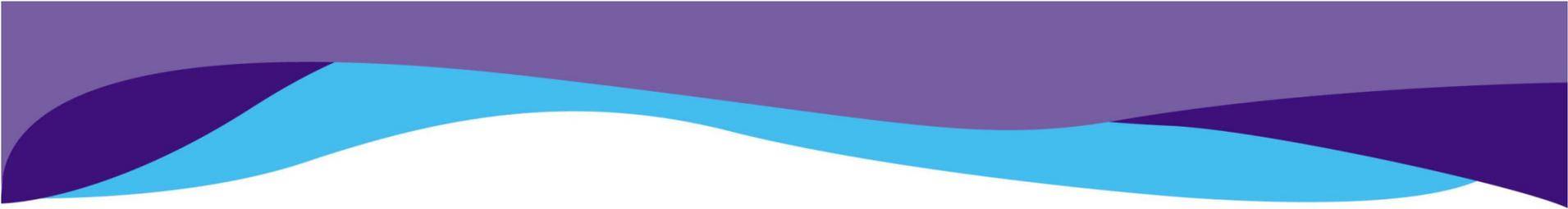


IFFO Responsible Supply Code

To be Code compliant the product must:

- Ω Be able to demonstrate that it derives from fisheries that are managed under the key elements of the FAO Code of Conduct for Responsible Fishing (e.g. MSC, RAPFISH +)
- Ω Come from a factory that can demonstrate that it has audited management procedures that avoid the use of IUU fish
- Ω Come from a factory that can demonstrate that it has audited management procedures that prevent contamination during production and storage





IFFO Responsible Supply Code - Timetable

- Ω Currently we are undertaking some trial pre-assessments followed by trial audits to ensure the criteria are delivered
- Ω Results will be presented to our multi-stakeholder Technical Advisory Committee who will make recommendations to the IFFO Board in May
- Ω The hope is to open the scheme and have product available before the year end.

