The feeding ecology of mesopelagic fishes off the South African west coast via stomach content and stable isotope analyses

**Lanternfish** and **Lightfish**

(Lampanyctodes hectoris) and (Maurolicus walvisensis)

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Mesopelagic fish biomass estimated at 1.7 million tons with approx. equal quantities of lanternfish and lightfish (Coetzee et al. 2006).

The Benguela Current is characterized by pulsed upwelling, which supports the majority of SA’s fisheries.
WHY MESOPELAGIC FISHES?
Well, they play a critical role in mediating energy transfers between...

LOWER & HIGHER TROPHIC LEVELS
SURFACE & DEEP-SEA ECOSYSTEMS

Zooplankton
Mesopelagic fish
Deep-sea hake

North
South

(Shannon et al. 2003) (Coetzee et al. 2006)

78% (Durholtz 2015)
In terms of biomass, lanternfish & lightfish may exert notable feeding pressure on zooplankton communities. Yet dietary information is sparse for either species.

Some questions addressed:
What trophic levels do they occupy?
What are they eating?
Resource partitioning?
Foraging strategies?

(Spring 2014)
(Autumn 2015)
Isotope signals represent the ratio of heavy and light isotopes ($^{15}$N/$^{14}$N; δ$^{15}$N and $^{13}$C/$^{12}$C; δ$^{13}$C).

**STABLE ISOTOPE ANALYSIS (SIA)**

- **Left:** Lipid extracted
  - δ$^{13}$C
  - Source production
- **Right:** non-extracted
  - δ$^{15}$N
  - C:N ratio
  - Trophic position
  - Lipid content

**STOMACH CONTENT ANALYSIS (SCA)**

- Sample
  - Stomach contents
  - Identify prey
  - Trophic position
  - Dietary carbon (%C)
  - Number (%N)
  - Occurrence (%F)
THE RELATIVE ISOSPACES of lanternfish and lightfish by season

**Lanternfish**

\[ \delta^{15}N: \] Lanternfish 13.57±0.04 ‰  \[ P<0.001 \]

**Lightfish**

\[ \delta^{13}C (\%) \]

\[ \delta^{15}N: \] Lightfish 12.54±0.11‰

\[ R^2 = 0.7538 \]
\[ p < 0.001 \]

\[ R^2 = 0.6062 \]
\[ p < 0.001 \]
FEEDING BEHAVIOUR zooplanktivores

Lanternfish

Lightfish

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- **Krill**
- **Amphipods (Sm.)**
- **Amphipods (Lg.)**
- **Fish eggs**
- **Mollusc larvae**
FEEDING BEHAVIOUR zooplanktivores

The diagram shows the numerical frequency of small and large zooplankton species based on their total length in millimeters. The x-axis represents total length (mm), ranging from 0 to 10, and the y-axis represents numerical frequency, ranging from 0 to 100. The bars indicate the frequency of small species, with a peak around 3 mm, and the line indicates the frequency of large species, with a peak around 6 mm.
THE EFFECT OF FISH SIZE on ingested prey size

Lanternfish

Exponential regression
$R^2 = 0.2152$
$p < 0.001$

Lightfish

DIET SWITCHING?
TROPHODYNAMICS in the southern Benguela

**LANTERNFISH**
- Higher trophic position
- Diet derived TL 4.21±0.03
- Macro-zooplanktivore
- More specialized predator

**LIGHTFISH**
- Lower trophic position
- Diet derived TL 3.85±0.03
- Meso-zooplanktivore
- Opportunistic predator (i.e. diet switching)
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