THREATS TO THE GLOBAL EPA + DHA OMEGA-3 INDUSTRY
“To increase omega-3 consumption of omega-3s to adequate levels worldwide, while setting high quality and ethical standards for our members”
ABOUT EPA+DHA

FOUR FUNCTIONS IN OUR CELLS

• Ensure proper functioning of proteins
• Regulate inflammation
• Modulate enzyme activity
• Regulate various gene expressions

Source: Norwegian Scientific Committee for Food Safety
EPA and DHA are the most-studied nutrients. They are also among the most studied compounds in human health, inclusive of pharmaceuticals.
ABOUT EPA + DHA

- Improve episodic memory
- Improve cognitive function
- Reduce Cardiac Death Risk
- Reduce Triglycerides
- Reduce Blood Pressure
- Reduce Heart Rate
- Increase HDL Cholesterol
- Reduce VLDL Cholesterol
- Increase LDL Cholesterol*

*Studies consistently show DHA increases LDL cholesterol, but also that it restructures cholesterol particles. The clinical impact is unknown.

- Reduce preterm birth rate
- Increase gestational length
- Contribute to visual development
- Contribute to brain development

About EPA + DHA

1,471,670
people died prematurely from low EPA+DHA intake due to ischemic heart disease in 2015 globally

US$6.1 BILLION
Potential healthcare savings by reducing early preterm birth rates with DHA in the US (AU$51 million in Australia)

31,329,827
Lost years of productivity globally due to low EPA and DHA intakes in 2015

$485 MILLION
Potential healthcare savings by reducing CHD in US with omega-3 supplementation

Americans are omega-3 deficient.

In every race and every age group, more than 90% of the population has omega-3 levels lower than are required for cardioprotection... and we know many other countries are similarly deficient.

Source: Murphy et al, Nutrients 2015
Supplements are important for addressing nutrient deficiency.

The nutrients in which we are most deficient are present in the least number of food choices available to consumers.

* There is no Daily Value for EPA+DHA in the US yet, we have utilized the WHO’s 250mg/day recommendation in this analysis.

Source: GOED Analysis of IOM and USDA data
Three questions:

• How are consumers spending their money?
• Is the ingredient market growing?
• Where is the growth?
Consumers spend $31 billion on products with added EPA and DHA.

The US is the largest single market, but Asia as a region is larger and growing faster, so attention has shifted.
Asia has become the leading market of interest.

The Asian market is both sizeable and growing quickly, while other high growth markets are smaller. The United States has become the slowest growing market in the world.
The East and Southeast Asian omega-3 market is expected to develop very quickly very soon. It's very likely that per capita spending for the relevant reasons will develop accordingly.

Source: GOED Proprietary Research

<table>
<thead>
<tr>
<th>Region</th>
<th>Per Capita Spending (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>$12.83</td>
</tr>
<tr>
<td>Canada</td>
<td>$5.57</td>
</tr>
<tr>
<td>US</td>
<td>$3.70</td>
</tr>
<tr>
<td>Japan</td>
<td>$2.05</td>
</tr>
<tr>
<td>Europe</td>
<td>$1.16</td>
</tr>
<tr>
<td>Rest of APAC</td>
<td>$0.49</td>
</tr>
<tr>
<td>Mexico</td>
<td>$0.35</td>
</tr>
<tr>
<td>China</td>
<td>$0.26</td>
</tr>
<tr>
<td>South America</td>
<td>$0.25</td>
</tr>
<tr>
<td>Rest of Asia</td>
<td>$0.05</td>
</tr>
<tr>
<td>Rest of World</td>
<td>$0.03</td>
</tr>
</tbody>
</table>
What if spending in developing countries reached European levels?

The global omega-3 market will be fine simply due to the pace of economic development in the world. Developing countries alone could triple the size of the market if per capita spending reaches European levels.

Source: GOED Proprietary Research
The global market is growing again.

Even though volumes are growing slightly, ingredient prices have been under pressure due to overcapacity.
The East and Southeast Asian omega-3 market is already developing very quickly. It is likely that this growth will continue in the coming years and market attention will remain in these regions.
Asia accounted for two-thirds of global growth in omega-3s last year.

While other countries contributed less, only Europe actually declined in 2016, primarily due to declines in 18/12-type dietary supplements.
ASSESSING RISKS

HOW IS MARKET RISK MEASURED?

Quantitatively measuring qualitative unknowns presents a challenge, but validated models do exist.
# ASSESSING RISK

Risk is a function of two factors. Potential threats and vulnerabilities can be scored for risk severity and exposure, and then the scores can be combined for a total risk score.

<table>
<thead>
<tr>
<th>SEVERITY</th>
<th>EXPOSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>HIGH</td>
</tr>
<tr>
<td>Significant loss potential, easily exploitable</td>
<td></td>
</tr>
<tr>
<td>All segments of value chain affected, vulnerabilities will likely cascade</td>
<td></td>
</tr>
<tr>
<td>MEDIUM</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>Significant loss potential and difficult to exploit, OR moderate loss potential and easily exploitable</td>
<td></td>
</tr>
<tr>
<td>More than one segment of value chain affected, increased risk of vulnerabilities cascading</td>
<td></td>
</tr>
<tr>
<td>MINOR</td>
<td>MINOR</td>
</tr>
<tr>
<td>Little potential for loss, difficult to exploit</td>
<td></td>
</tr>
<tr>
<td>Vulnerability tightly contained to one segment or company and little chance of it leading to additional vulnerabilities</td>
<td></td>
</tr>
</tbody>
</table>

Source: SANS Institute
ASSESSING RISK

- Neutral CHD studies
- Bleeding risk
- Safety studies
- EE Class Action Lawsuit
- O6/O3 Debate
- Single nutrient vs. whole food

SCIENCE

- Oxidation
- EPA/DHA Content
- Lack of Methods
- Perception of low quality
- Traceability / adulteration

QUALITY

- Lack of EPA in fisheries
- Low Anchoveta yields
- Perceptions of sustainability
- Climate change
- Variability in other fisheries

ENVIRONMENT

- Losses in concentrates
- Negative marketing
- Transparency / consumer trust

MARKET

- NDI Guidance
- No blood pressure claim
- Omega-3 oils not listed in China
- No DRI in the US/Canada

REGULATORY

- Overall negative sentiment
- Inaccurate reporting

MEDIA

Source: GOED Proprietary Surveys
## ASSESSING RISK

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Loss Potential</th>
<th>Ease of Exploitation</th>
<th>Severity Score</th>
<th>Segments Affected</th>
<th>Cascade Potential</th>
<th>Exposure Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral CHD Studies</td>
<td>8.1</td>
<td>9.2</td>
<td>8.7</td>
<td>9.2</td>
<td>9.7</td>
<td>9.4</td>
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<tr>
<td>Bleeding risk</td>
<td>2.9</td>
<td>7.1</td>
<td>5.0</td>
<td>7.7</td>
<td>8.0</td>
<td>7.8</td>
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<tr>
<td>Safety studies</td>
<td>9.4</td>
<td>9.6</td>
<td>9.5</td>
<td>8.8</td>
<td>10.0</td>
<td>9.4</td>
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<tr>
<td>Lack of EPA in Anchoveta fishery</td>
<td>4.1</td>
<td>4.0</td>
<td>4.1</td>
<td>3.8</td>
<td>4.0</td>
<td>3.9</td>
</tr>
<tr>
<td>Low Anchoveta yields</td>
<td>4.0</td>
<td>4.6</td>
<td>4.3</td>
<td>5.2</td>
<td>4.8</td>
<td>5.0</td>
</tr>
<tr>
<td>Perceptions of sustainability</td>
<td>4.6</td>
<td>6.1</td>
<td>5.4</td>
<td>4.7</td>
<td>6.3</td>
<td>5.5</td>
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<tr>
<td>NDI Guidance</td>
<td>5.8</td>
<td>4.5</td>
<td>5.2</td>
<td>6.0</td>
<td>4.6</td>
<td>5.3</td>
</tr>
<tr>
<td>No BP claim</td>
<td>3.7</td>
<td>5.9</td>
<td>4.8</td>
<td>3.2</td>
<td>5.2</td>
<td>4.2</td>
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<tr>
<td>Omega-3s not listed in China</td>
<td>6.4</td>
<td>5.0</td>
<td>5.7</td>
<td>3.2</td>
<td>3.7</td>
<td>3.4</td>
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<tr>
<td>Oxidation</td>
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<td>7.9</td>
<td>7.4</td>
<td>7.0</td>
<td>8.9</td>
<td>7.9</td>
</tr>
<tr>
<td>EPA/DHA Content</td>
<td>5.4</td>
<td>5.9</td>
<td>5.6</td>
<td>4.7</td>
<td>8.7</td>
<td>6.7</td>
</tr>
<tr>
<td>Lack of methods</td>
<td>3.7</td>
<td>4.0</td>
<td>3.8</td>
<td>3.8</td>
<td>5.3</td>
<td>4.6</td>
</tr>
<tr>
<td>Losses in concentrates</td>
<td>5.3</td>
<td>3.5</td>
<td>4.4</td>
<td>3.2</td>
<td>3.8</td>
<td>3.5</td>
</tr>
<tr>
<td>Overall negative media</td>
<td>7.7</td>
<td>8.1</td>
<td>7.9</td>
<td>9.4</td>
<td>9.7</td>
<td>9.6</td>
</tr>
<tr>
<td>Inaccurate reporting</td>
<td>8.1</td>
<td>8.1</td>
<td>8.1</td>
<td>9.1</td>
<td>10.0</td>
<td>9.6</td>
</tr>
<tr>
<td>No DRI</td>
<td>6.7</td>
<td>6.0</td>
<td>6.4</td>
<td>8.9</td>
<td>3.7</td>
<td>6.3</td>
</tr>
<tr>
<td>Ethyl Ester class action</td>
<td>5.3</td>
<td>8.0</td>
<td>6.6</td>
<td>4.9</td>
<td>5.3</td>
<td>5.1</td>
</tr>
<tr>
<td>Debate on the O6/O3 issue</td>
<td>2.7</td>
<td>2.6</td>
<td>2.6</td>
<td>2.7</td>
<td>1.7</td>
<td>2.2</td>
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<tr>
<td>Perceptions of quality</td>
<td>4.1</td>
<td>6.9</td>
<td>5.5</td>
<td>5.0</td>
<td>8.0</td>
<td>6.5</td>
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<tr>
<td>Climate change</td>
<td>5.9</td>
<td>6.3</td>
<td>6.1</td>
<td>4.4</td>
<td>6.0</td>
<td>5.2</td>
</tr>
<tr>
<td>Variability in yield/biomass in all fisheries</td>
<td>4.9</td>
<td>3.6</td>
<td>4.2</td>
<td>4.4</td>
<td>3.7</td>
<td>4.1</td>
</tr>
<tr>
<td>Single nutrient vs Whole food debate</td>
<td>6.1</td>
<td>5.0</td>
<td>5.6</td>
<td>6.0</td>
<td>4.1</td>
<td>5.1</td>
</tr>
<tr>
<td>Negative competitive marketing</td>
<td>5.7</td>
<td>6.3</td>
<td>6.0</td>
<td>4.0</td>
<td>5.9</td>
<td>4.9</td>
</tr>
<tr>
<td>Lack of transparency/consumer trust</td>
<td>7.9</td>
<td>7.9</td>
<td>7.9</td>
<td>8.0</td>
<td>7.6</td>
<td>7.8</td>
</tr>
<tr>
<td>Traceability / Adulteration</td>
<td>6.0</td>
<td>4.9</td>
<td>5.4</td>
<td>5.1</td>
<td>5.9</td>
<td>5.5</td>
</tr>
</tbody>
</table>
ASSESSING RISK

GOED Assessment of Industry Risks

- Safety studies
- Neutral CHD Studies
- Inaccurate reporting
- Overall negative media
- Lack of transparency/consumer trust
- Oxidation
- Bleeding risk
- No DRI
- EPA/DHA Content
- Perceptions of quality
- Ethyl Ester class action
- Climate change
- Negative competitive marketing
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- Perceptions of sustainability
- Single nutrient vs Whole food debate
- NDI Guidance
- Low Anchoveta yields
- Omega-3s not listed in China
- No BP claim
- Lack of methods
- Variability in yield and biomass in all fisheries
- Lack of EPA in Anchoveta fishery
- Losses in concentrates
- Debate on the O6/O3 issue

Source: GOED Staff Survey
ASSESSING RISK

Why Is Assessing Risk Important?

- **Prostate Cancer Study**: 2012
  - RISK EVENT
  - IMPACT: 12 million consumers leave omega-3s

- **Cholesterol Claims in the US**: 1989
  - RISK EVENT
  - IMPACT: 87% consumption decline

- **Krill Oil Claims in Australia**: 2013
  - RISK EVENT
  - IMPACT: 33% consumption decline

- **US Seafood Advisory**: 2004
  - RISK EVENT
  - IMPACT: 13% consumption decline

- **NZ Oxidation Study**: 2015
  - RISK EVENT
  - IMPACT: 12% consumption decline

- **Chinese Cod Liver Oil Contamination**: 2014
  - RISK EVENT
  - IMPACT: 59% consumption decline

Source: GOED Proprietary Research, NOAA, Nielsen, AZTEC
For both industry and academia, reacting only to singular events, rather than pursuing strategies to address challenges can hinder growth and future investment.
The same safety questions are repeatedly raised.

There is little data to support these concerns, but there is ample data that shows they are not actually risks to consumers. The main challenge is that because most serious scientists accept that there is little risk, few papers exist to translate the data into a coherent case.
The impact on research could be severe.

The media story around the 2012 prostate cancer study affected recruitment for the VITAL study, the largest CVD primary prevention study to date. Researchers have been forced to turn to databases of frequent clinical study participants.

A failure of this study could have a large negative toll on consumption of omega-3s.
ADDRESSING CHALLENGES | SAFETY STUDIES

TACTIC TO ADDRESS ISSUE

☑ Meta-analysis of RCTs, biomarkers, and observational studies

- Meta-analysis of adverse event endpoints from studies
- Review of adverse event reporting data

- Hazard characterization of aldehyde, ketone and oxidized lipid exposure
- Analysis of oxidative compounds in omega-3 oils and the food supply

REASON TO BELIEVE
The prostate cancer discussion has largely ended, in part because we published a comprehensive meta-analysis on the topic and engaged our critics in a discussion, but damage has been done.
Again, scientific papers have raised questions.

The key issue here is that they raise the questions and purport to answer them conclusively, but miss the nuance of their own questions. For instance, a study may raise the question of whether omega-3s are beneficial for the heart health, but only include studies in post-MI patients or ignore areas where they do see benefits. This actually raises more questions and does not answer the underlying question. **We need to build the case that omega-3s contribute to a healthy heart.**
ADDRESSING CHALLENGES | NEUTRAL CHD STUDIES

- Meta-analysis of omega-3s on the function of the 14 parts of the heart
- Meta-analysis of omega-3s on the 36 biomarkers of CVD and CHD
- Systematic review on measures of quality of life in heart disease patients (ie, depression) and recovery.

It is clear that influential heart groups are influenced by science, but they are being influenced by poorly designed science with respect to omega-3s. Designing better studies should at least call their assumptions into question, and if we can compare the effects of omega-3s to well-accepted drugs, perhaps we can change opinions.
Paper was published on January 3rd.

1. Published in the Mayo Clinic Proceedings
2. Non-statistically significant 6% reduction in CHD risk from RCT data
3. Statistically significant 18% reduction from prospective cohorts
4. Statistically significant reductions in CHD risk for populations with elevated triglycerides and cholesterol levels
5. Statistically significant reduction in coronary death risk
6. Other meta-analyses have not separated out vascular outcomes, leading to mixed results
NEUTRAL CHD STUDIES

Meta-Analysis Models of Trials Assessing Cardiac Death Outcomes for EPA/DHA Interventions

<table>
<thead>
<tr>
<th>Group / Subgroup</th>
<th>Subjects</th>
<th>Relative Risk</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Analysis</td>
<td>71,899</td>
<td>0.920</td>
<td>0.011</td>
</tr>
<tr>
<td>Secondary Analysis</td>
<td>83,031</td>
<td>0.929</td>
<td>0.013</td>
</tr>
<tr>
<td>&gt;1g EPA+DHA per day</td>
<td>20,418</td>
<td>0.709</td>
<td>0.043</td>
</tr>
<tr>
<td>Elevated TGs</td>
<td>44,008</td>
<td>0.826</td>
<td>0.005</td>
</tr>
<tr>
<td>Elevated LDL</td>
<td>44,188</td>
<td>0.828</td>
<td>0.005</td>
</tr>
<tr>
<td>Secondary Prevention</td>
<td>27,111</td>
<td>0.870</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Statin Use &lt;40%</td>
<td>20,192</td>
<td>0.871</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Published ahead of print, August 2.

1. Published in *Journal of Clinical Lipidology*
2. Cardiac death has not been a primary outcome in a peer-reviewed omega-3 paper prior to this paper
3. No subgroup analyses have ever been conducted on cardiac death outcomes
4. These findings are only somewhat novel, but continue to define the case for how omega-3s are still beneficial to the heart

Source: 10.1016/j.jacl.2017.07.010
ADDRESSING CHALLENGES | THE MEDIA

US Retail Omega-3 Sales vs. Media Sentiment

- ORIGIN Study
- Relatively Positive News Stabilizes Market
- Lots of Positive News Stabilizes Market
- Weather
- Rizos Study
- Brasky Study
- Gray & Bolland Article
- NYT & JAMA Articles

Source: AC Nielsen, GOED Analysis of Meltwater and Factiva data
ADDRESSING CHALLENGES | THE MEDIA

Bullet
What are they firing?

- Peer-reviewed papers

Caliber
How powerful is it?

- Top-tier journals & respected institutions

Trigger
How do they fire it?

- Press releases

Battlefield
Where do they aim it?

- Consumer media

Source: AC Nielsen, GOED Analysis of Meltwater and Factiva data
# ADDRESSING CHALLENGES | THE MEDIA

<table>
<thead>
<tr>
<th>Bullet</th>
<th>Caliber</th>
<th>Trigger</th>
<th>Battlefield</th>
</tr>
</thead>
<tbody>
<tr>
<td>116 RCTs and other significant papers</td>
<td>19 Published in top-tier journals or from top institutions</td>
<td>18 Papers promoted with press releases</td>
<td></td>
</tr>
</tbody>
</table>

**Number of Consumer Stories Published**

<table>
<thead>
<tr>
<th></th>
<th>No Press Release</th>
<th>Press Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top-Tier</td>
<td>42</td>
<td>386</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
<td>929</td>
</tr>
</tbody>
</table>
ADDRESSING CHALLENGES | THE MEDIA

**Media Reporting**

- **Inaccurate Reporting**
  - Build network of media-trained scientists
  - Engage reporters who inaccurately report on omega-3 science

- **Overall Negative Sentiment**
  - Promote positive studies to balance out the large media coverage of the few neutral studies

**REASON TO BELIEVE**
Since we started our PR effort, the media sentiment has improved considerably, more reporters are approaching GOED for stories on omega-3s, and we have been successful in getting coverage for omega-3 studies.
ADDRESSING CHALLENGES | THE MEDIA

US Media Sentiment 2008-2017

GOED Campaigns

Source: GOED Analysis of Meltwater and Factiva data
KEY TAKEAWAYS

1. Omega-3s are vital nutrients for human nutrition and most people in the world do not consume adequate amounts.

2. The omega-3 oil industry and seafood industry are contributing positively to population intakes of EPA and DHA.

3. If industry and academia do not work together to mitigate risk events, we will constantly face crises that erode trust in omega-3s.

4. There are achievable strategies that can help mitigate risk that ultimately benefit public health.
ABOUT US

HOW TO ACCESS THIS DATA FOR YOURSELF
This data represents only part of GOED’s proprietary research, and is freely available at varying degrees of curation to Plus-level members of the organization.

HOW TO JOIN GOED
Please contact Mike Roberts at mike@goedomega3.com with any questions about membership.

QUESTIONS ABOUT THIS PRESENTATION
Please contact Adam Ismail at adam@goedomega3.com with any additional questions regarding this presentation.