



COMPENDIUM OF STELLER SEA LION RELATED RESEARCH, 2000-2006

Prepared by:

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On behalf of Chris Oliver, Executive Director
North Pacific Fishery Management Council
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Contract # 2005-02

Contractor will

1. Identify all relevant SSL related research conducted from the year 2000 to present, including gray literature;
2. Compile brief (one or two page) summaries of each research project and results; and,
3. Synthesize these various research findings into major (thematic) categories with attendant summary results (relevant categories to be determined by contractors in consultation with Council staff).

The contractors will also provide a single master copy of research papers referenced in the compendium report.

Themes for NPFMC Compendium (from AFSC web page)

1. Life history- genetics, physiology/anatomy, reproduction/behavior, and sundry
2. Foraging – diet, searching for prey, and models
3. Vital rates – including status and trends
4. Fish assessment and fisheries
5. Ecosystems
6. Anthropogenic effects
7. Predation
8. Disease
9. Contaminants
10. Management – not included
11. Communications

Principal organizations conducting SSL research

1. AFSC -- NMML
2. AFSC – RACE/REFM/Auke Bay
3. ADFG
4. Consortium – UBC, UW, UA, OSU
5. Alaska SeaLife Center
6. Univ. AK -- not consortium
7. NOAA -- PMEL
8. NOAA -- NOS
9. Prince William Sound Science Center

Example of product #1

ALPHABETICAL CITATION LIST FOR THE NORTH PACIFIC FISHERIES MANAGEMENT COUNCIL'S SUMMARY OF STELLER SEA LION RESEARCH, 2000-2006

Adams, C.F. 2005. Physical and biological effects on the diel vertical migration of walleye pollock. Chapter 34, pages 331-336, *in* Loughlin, T. R., S. Atkinson, and D. G. Calkins (eds.), Synopsis of research on Steller sea lions: 2001 - 2005. Alaska SeaLife Center's Steller Sea Lion Program. Sea Script Company, Seattle, WA. 344 p.

Adams, T.C. 2000. Foraging differences and early maternal investment in adult female Alaskan Steller sea lions (*Eumetopias jubatus*). Ph.D. dissertation, Texas A&M University. 150 p.

ADFG and NMFS. 2001. Satellite telemetry & Steller sea lion research. A 'white paper' prepared for the North Pacific Fisheries Management Council. 16 pp. Available, National Marine Mammal Laboratory, 7600 Sand Point Way, NE, Seattle, WA 98115.

Example of product #2

THEME 2A – FORAGING – DIET

SUMMARY:

This theme had major effort during the review period and contains 91 articles including 58 presentations at scientific meetings, four reports, two unpublished reports, two theses and one dissertation, and 24 papers in peer-reviewed journals or book chapters. The major focus of research dealt with efforts to describe SSL prey items through analysis of scat, stable isotopes, and fatty acids, relate diet to available prey fields, define the energetic value or quality of various prey items, and (4) general themes dealing with prey and SSLs.....

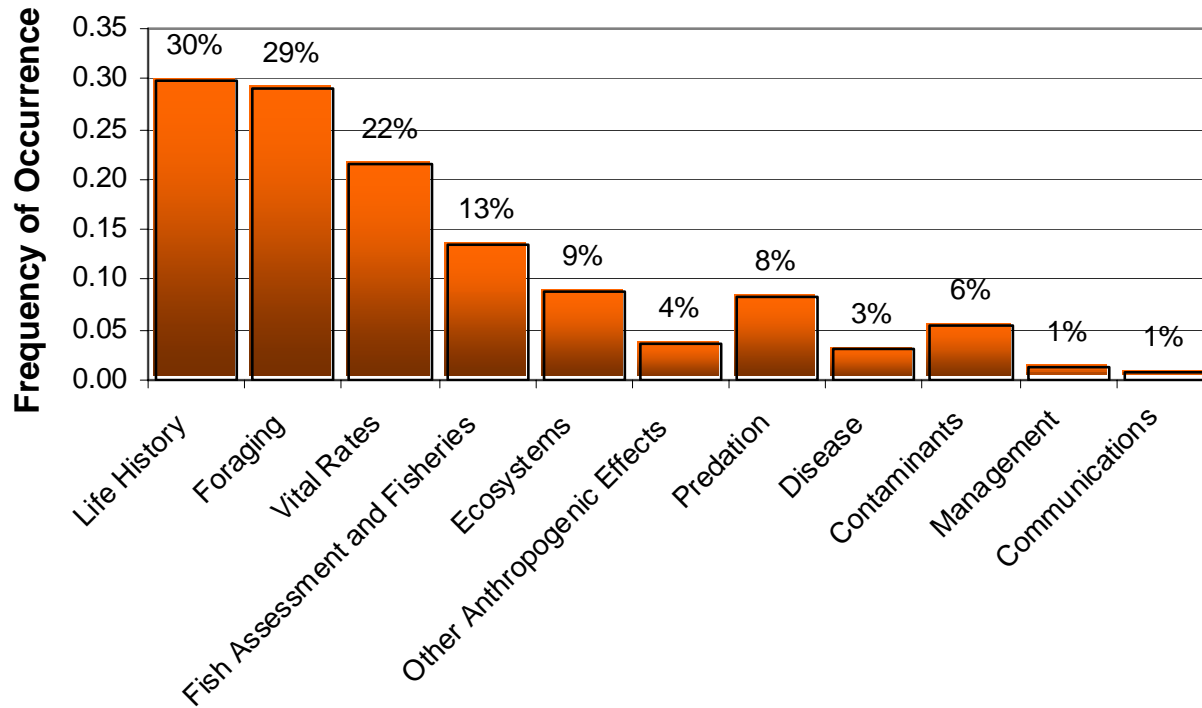
ANNOTATED BIBLIOGRAPHY – FORAGING – DIET

Bando, M. 2002. Proximate compositions of Steller sea lion prey items. M.S. thesis, Alaska SeaLife Center, Seward, AK, and University of Alaska, Fairbanks, AK.

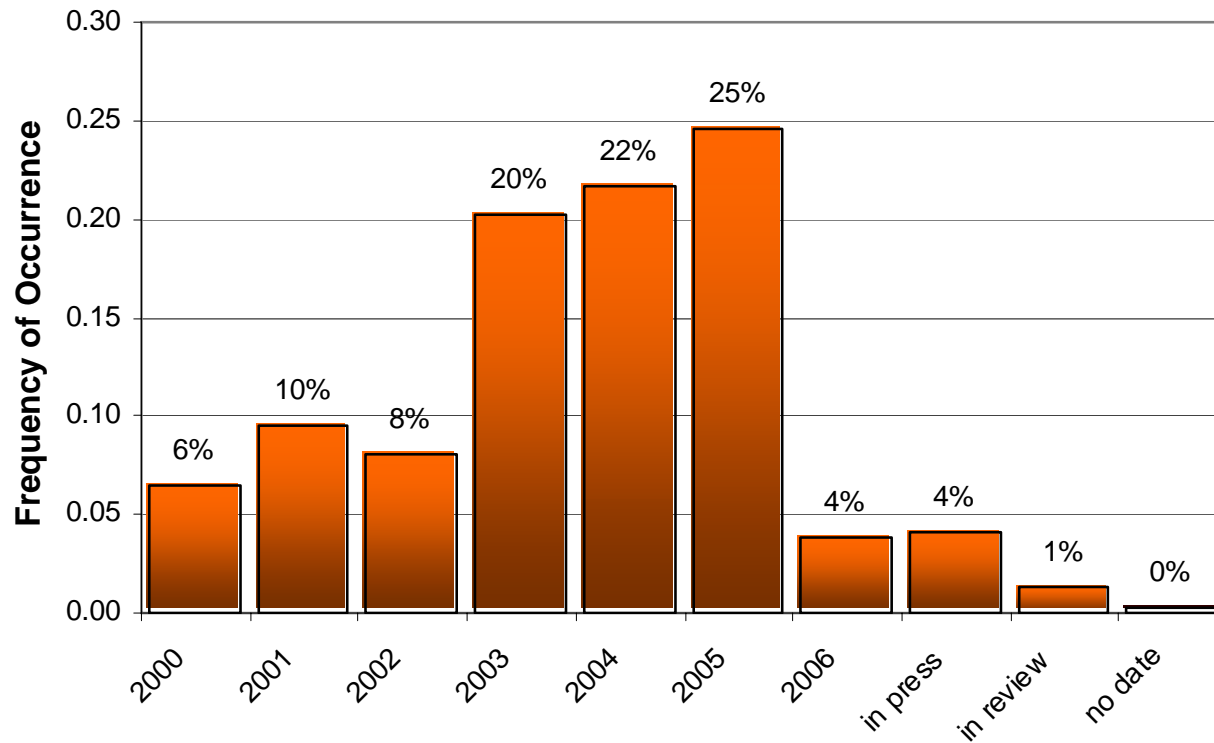
This Master's thesis focused on the quality of SSL prey during different feeding regimes applied to captive animals. The author states that nutritional stress may be attributable to reduced preferred prey availability and/or prey quality and could be the result of commercial fisheries removals or, alternately, environmental changes such as

Major Thematic Categories

References may occur in more than one category



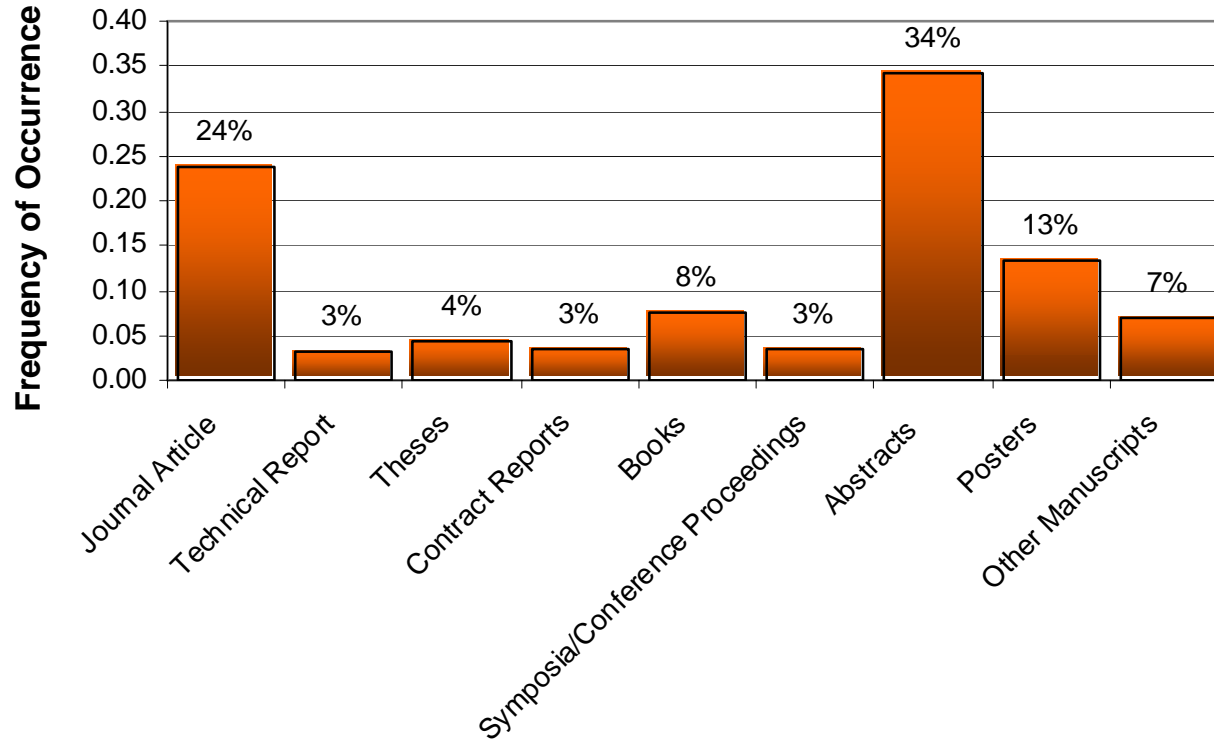
Distribution by Year



Citation type by year

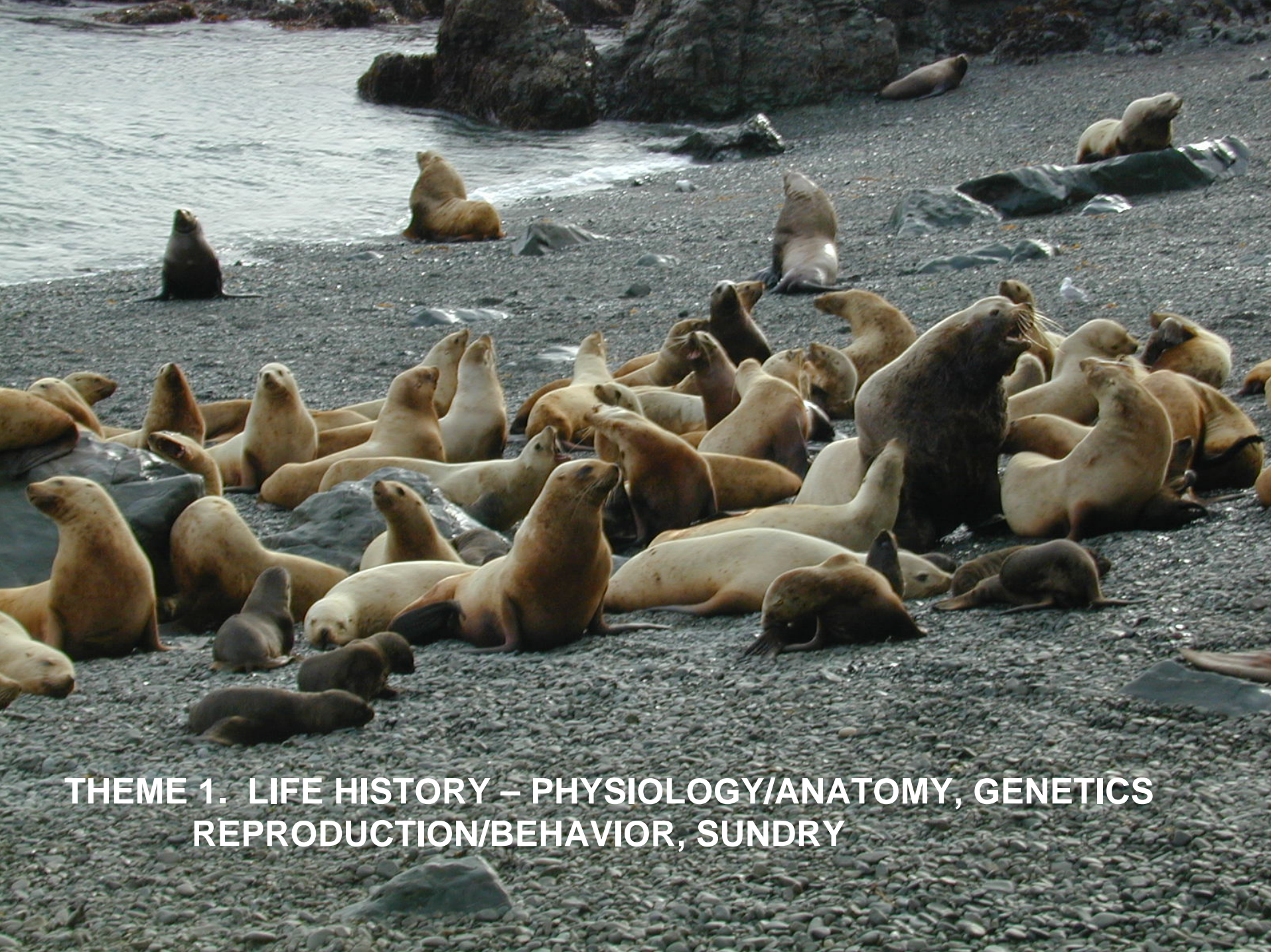
	Year										
Reference Type	2000	2001	2002	2003	2004	2005	2006	in press	in review	no date	Total
Journal Article	27	18	23	18	24	35	6	18	10		179
Technical Report	2	5	5	4	2	5					23
Theses	4	6	5	4	6	7	1				33
Contract Reports	1		5	6	4	9				1	26
Books		1	2	3	2	37		12			57
Symposia/Conference Proceedings	7	1	1	8	3	5		1			26
Abstracts		28	16	106	61	28	19				258
Posters					55	44	1				100
Other Manuscripts	8	13	4	3	6	15	2			1	52
Total	49	72	61	152	163	185	29	31	10	2	754

Distribution by Type



Citation type by theme

Reference Type	Thematic Classification										
	Life History	Foraging	Vital Rates	Fish Assessment and Fisheries	Ecosystems	Other Anthropogenic Effects	Predation	Disease	Contaminants	Management	Communications
Journal Article	55	43	23	30	33	1	21	5	5		
Technical Report		2	13	3	1	4	6				2
Theses	13	10	7	4	2	1		1		1	
Contract Reports	1	7	8	6	2	5	4	1	1		
Books	18	15	11	6	5	1	6	2	5	1	1
Symposia/Conference Proceedings	6	5	1	3	1		1	2	10		1
Abstracts	82	83	60	23	8	6	16	8	14	4	
Posters	33	36	23	7	3	6		3	3	1	
Other Manuscripts	7	8	10	15	9	2	5	1	2	2	1
Total	215	209	156	97	64	26	59	23	40	9	5



**THEME 1. LIFE HISTORY – PHYSIOLOGY/ANATOMY, GENETICS
REPRODUCTION/BEHAVIOR, SUNDRY**

Theme 1a – Life History– Physiology/Anatomy

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
101	49	2	7	43

General physiology and metabolism

Physiology of diving and ontogeny of body oxygen

Physiological implications of food deprivation

Hormone detection and assessment

Growth and condition

Anatomical topics

Vitamins

Theme 1b – Life History-- Genetics

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
23	11	0	4	8

TAMU group - three-stock hypothesis; evolutionary history and four glacial refugia

SWFSC group - dispersal rates between rookeries; 'oceanic' vs 'shelf' rookeries

Cambridge group - importance of inbreeding depression; valid 3rd stock?

Others – Scats to identify prey and haplotype seasonal movements in Alaska
major histocompatibility complex (MHC)
cytokines (ASLC)

Theme 1c – Life History– Reproduction/Behavior

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
39	27	0	1	11

Attendance patterns, nursing duration, and estimates of weaning age

Pup and juvenile growth

Dispersal and rookery fidelity

Theme 1d – Life History-- Sundry

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
50	33	2	1	15

Rookery and habitat characterization

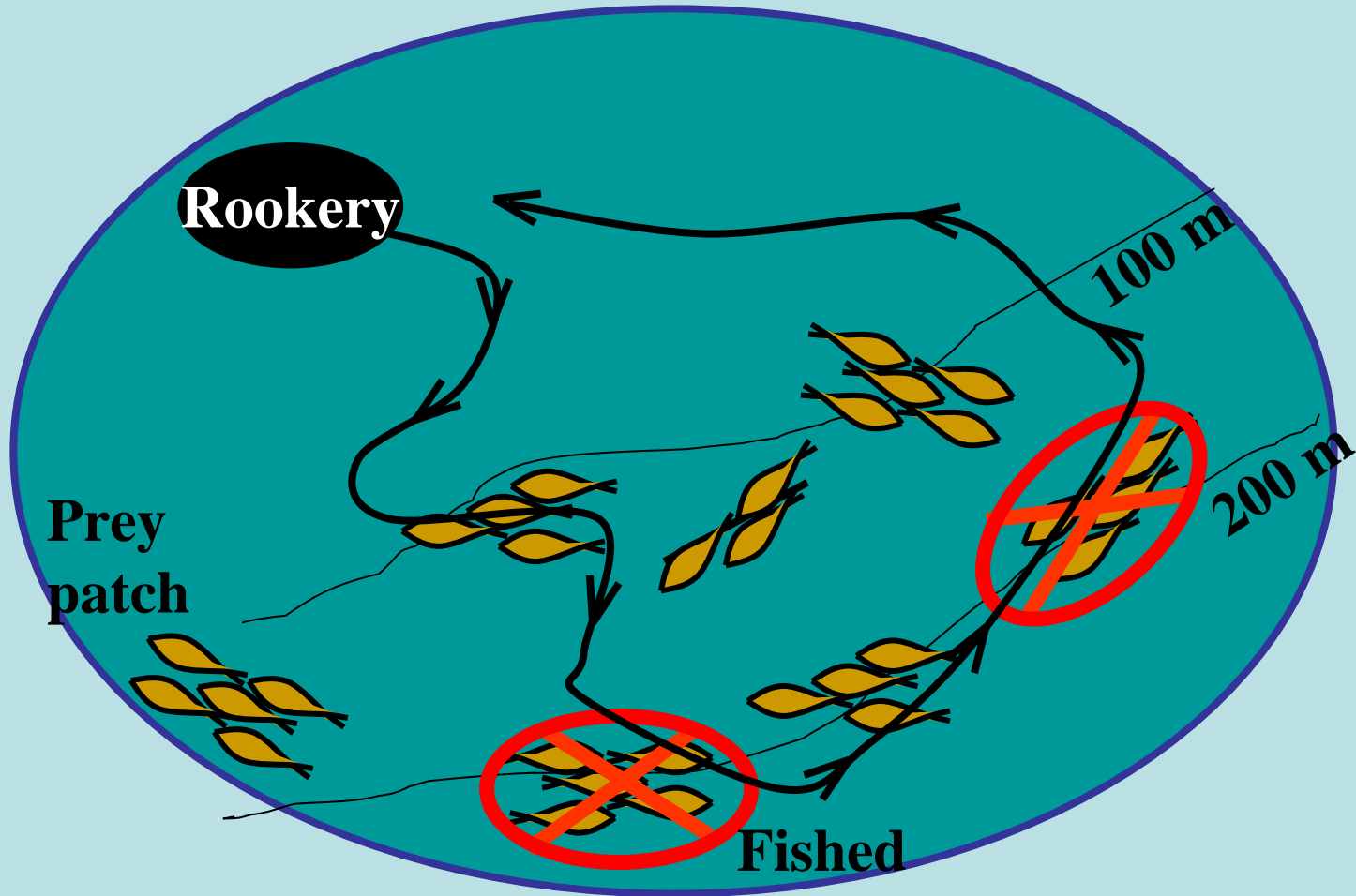
Behavior (not breeding or foraging)

New techniques

Electronics

Distribution

THEME 2. FORAGING – DIET, SEARCHING FOR PREY, MODELS



Hypothetical foraging trip

Theme 2a – Foraging -- Diet

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
91	58	6	3	24

SSL prey identified through analysis of scat, stable isotopes, and fatty acids

Related diet to available prey fields

Defined the energetic value or quality of various prey items

General themes dealing with prey and SSLs.

Theme 2b– Foraging – Searching for prey

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
51	33	4	2	12

Focus on younger animals

Technological improvements in instruments including analysis of dive data

Linking of sea lion dive behavior and foraging activity to habitat features and available prey fields

Report to the NPFMC's SSL Mitigation Committee summarizing SSL telemetric techniques, analytical methods, and results up to the year 2000

Independent review of the federal government's telemetry research program

Theme 2c – Foraging – Models and hypotheses

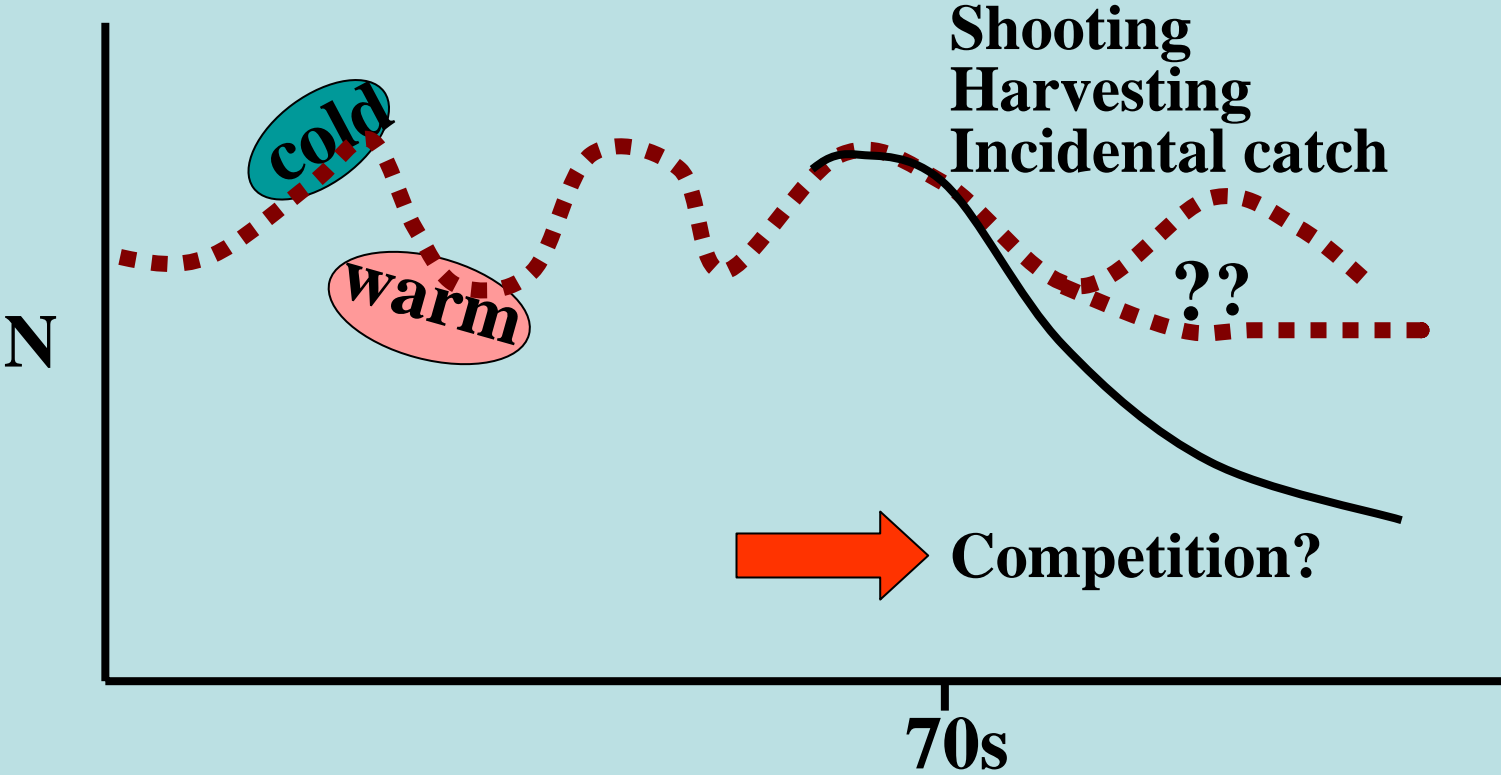
Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
71	31	7	5	28

The significant contributions were those pertaining to testing the ‘junk food’ hypothesis through captive studies and modeling. Results in the early 2000s from captive studies by Rosen and associates were the driving force for much of the research from 2000 to 2006 related to prey quality and its effect on SSL health and condition.

Rosen and Trites (2000a) was the pivotal paper that set much of the research in motion

The validity of the junk-food hypothesis was challenged by Fritz and Hinckley (2005) who reviewed available data and found little support for the hypothesis that increases in the availability and consumption of gadids following the regime shift are primarily responsible for the decline of the western population of SSLs.

THEME 3 – VITAL RATES – INCLUDING STATUS AND TRENDS



Theme 3 – Vital Rates

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
156	94	21	7	34

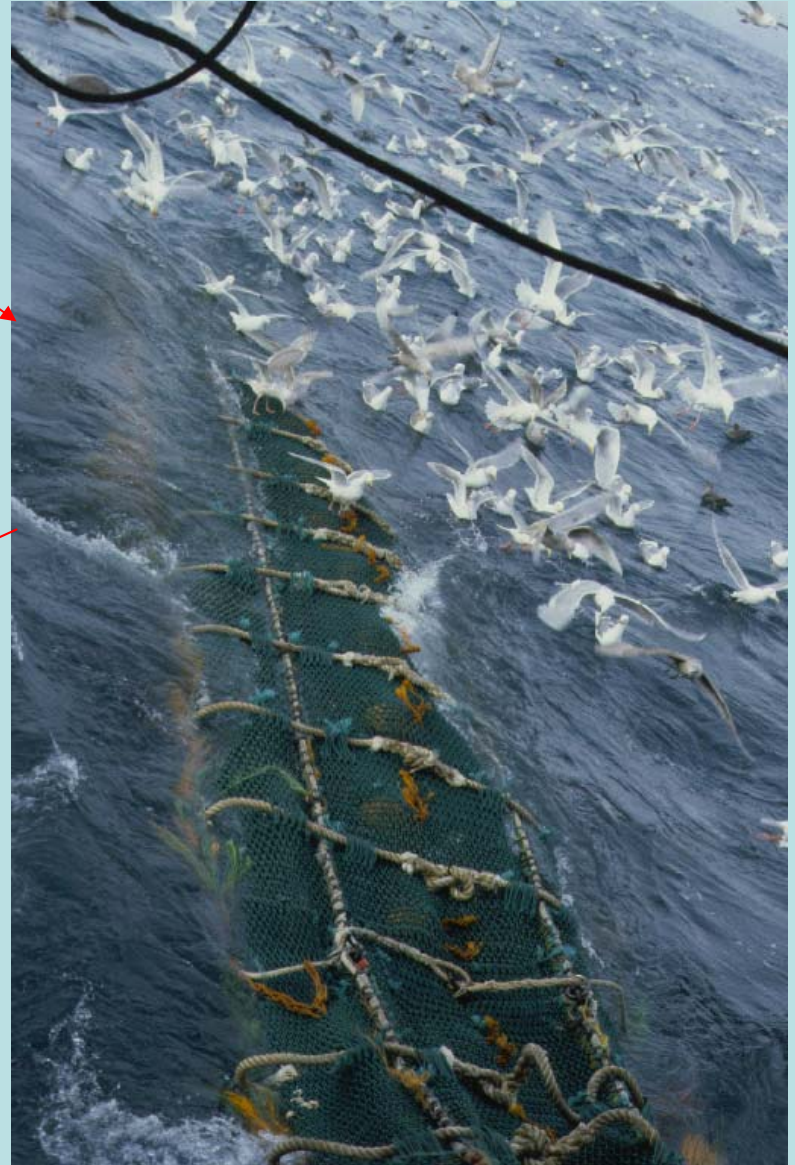
Abundance and population trends

Movement

Birth rates

Models

THEME 4 – FISH ASSESSMENT AND FISHERIES



Theme 4 – Fish Assessment and Fisheries

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
97	48	9	4	36

Principle prey species – Abundance trends

BSAI: pollock, Pacific cod, Atka mackerel

GOA: pollock, Pacific cod, Atka mackerel

Fishery/Steller sea lion interactions

Competition for prey fishery and Steller sea lion correlation studies

Seasonal prey use

THEME 5. ECOSYSTEMS



Theme 5 – Ecosystems

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
64	21	3	2	38

Top-down Hypotheses

Springer et al. sequential megafaunal collapse

Hunt et al. – oscillating control hypothesis

Bottom-up Hypotheses

Regime shifts

Other Ecosystem Observations

THEME 6. ANTHROPOGENIC EFFECTS



THEME 6 – ANTHROPOGENIC EFFECTS

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
25	11	11	1	2

Review of sanctioned SSL kills in Japan

Annual reports of subsistence kills in Alaska

Perryville TKW and surveys

Possible injury from fishing gear

Indirect impacts from harassment due to research activities

THEME 7. PREDATION



Theme 7 – Predation

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
59	22	10	0	27

Predation by sharks – sleeper and salmon

Predation by killer whales

Abundance

Diet preferences

Effects of predation on SSLs

Ecosystem considerations

THEME 8. DISEASE



Theme 8 – Disease

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
22	11	3	1	7

Identified hookworms in SSLs of the same genus (*Uncinaria*) found in California sea lions.

Review by Burek and colleagues provided a good summary of the prevalence and exposure of SSLs to disease over the past three decades. Their conclusions support earlier statements and assertions that disease was not the principle cause of SSL declines in the 1970s through the 1990s

The summary of a workshop in 2004 (Goldstein 2005) provides a useful guide to investigators for future SSL disease studies and techniques for sample collection and analysis.

THEME 9 -- CONTAMINANTS



Theme 9 -- Contaminants

Total citations	Talks/posters	Reports	Thesis/ dissertation	Journal or book chapters
41	29	4	0	8

Most studies concluded that pollutants could have had a role in the decline of SSLs but none provide a link between the decline and pollutant levels. Lack the next step as to what these high levels (or presence in most cases) mean biologically to individual SSL survival or reproduction; none address effects at the population level.

The Alaska SeaLife Center studied OCs toxicity and effects on immune function, primarily in pups and juveniles.

ADFG monitored metals and organochlorines in scat and in tissues and found significant correlations between OC exposure and impaired immune function at several levels and suggested that OCs be considered as contributing factors in the decline of the western DPS in Alaska.

J.P. Wise showed exposure to chromium and arsenic posed a significant risk factor for the health of SSLs and both metals are likely contributing to their decline and inability to recover.

The NMFS Auke Bay Laboratory analyzed fish that are documented as part of the SSL diet and found arrowtooth flounder presented the greatest risk of exposure to PCBs. They produced a report suggesting that there were insufficient data to reject the hypothesis that contaminants played a role in the continued decline of SSLs, and suggested a coordinated monitoring program be developed.


THEME 11. COMMUNICATIONS

National Marine Mammal Laboratory Satellite Telemetry page - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Shop Stop

Bookmarks Location: <http://nmml.afsc.noaa.gov/AlaskaEcosystems/sslhome/Satellite/Default.htm> What's Related

 **National Marine Mammal Laboratory**
Alaska Fisheries Science Center

The National Marine Mammal Laboratory (NMML) conducts **RESEARCH** on marine mammals worldwide, primarily coastal California, Oregon, Washington and Alaska

Steller Sea Lions

- Population
- Telemetry Data
- Databases
- Program
- Images
- SSL Downloads
- SSL Links


Research Programs

- What is NMML
- Search
- New at NMML
- Sitemap
- NMML Library
- NMML Publications
- Image Gallery
- Software
- Marine Mammal Law
- Education Web
- Mammal Links
- NMML Homepage

Webmaster
Disclaimer
Privacy
Information
Employment Details
Accessibility
Text Only Pages
NOAA Staff Locator

Alaska Fisheries
Science Center
National Marine

Alaska Ecosystem Program Telemetry Research Page



[Overview](#)

[Capture Methods and Instrumentation](#)

[Data Collection and Processing](#)

[Deployment Maps](#)

[Stellers and Technology Movie](#)

[User Guide](#)

Steller sea lion with transmitter, back with his buddies. Photo was taken July 29, 2002. The transmitter was attached on July 27, 2002.

Abstract

Document: Done

start Cardfile - NA... WordPerfect ... O4budget 2 Netscape ... Microsoft Po... 2:13 PM

Theme 11 -- Communications

Total citations	Symposia/ meetings	Processed report	Web pages	Books
35	10	1	22	2

Sea Lions of the World Symposium (2004)

Marine Science in the Northeast Pacific (2003 – 2006)

Marine Mammal Society biennial meetings (2001, 2003, 2005)

Marine Mammals of the Holarctic (2002, 2004)

DeMaster, D. and S. Atkinson (eds). 2002. Steller sea lion decline: Is it food II.

Fadely, B.S., editor. 2001. Steller sea lion investigations, 2000

Loughlin, T. R., S. Atkinson, and D. G. Calkins (eds.). 2005. Synopsis of research on Steller sea lions: 2001 – 2005.

Web pages



“Significant” Contributions/Events – 2000 - 2006

Western stock increases ~3%/year

Transient research facility at ASLC

Studies at sea by UBC using captive SSL

Remote video system

Linking telemetry and oceanography

Six cohorts of individually identifiable animals in USA and Russia for vital rates, behavior, movements, etc.

Involvement of additional organizations and scientists bringing new ideas and methods